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PLANT
INDUSTRY
DIVISION



Annual Report
1990 - 91

Alberta
AGRICULTURE

PLANT INDUSTRY DIVISION ANNUAL REPORT

1990 - 91

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Administrative Assistant
Secretary

Mr. Don Macyk
Ms. Debbie Wallace
Ms. Marilyn Touchette

CROP PROTECTION BRANCH

Head
Office Manager
Accounting Clerk
Technical Information Clerk
Word Processing Operator

Head, Entomology and
Rat Control Section
Research Entomologist (Olds)
Extension Entomologist (Brooks)

Head, Weed Control Section
Supervisor, Preventive and
Regulatory Services
Supervisor, Weed Research
and Development
Supervisor, Integrated Weed Control
Equipment Specialist
Crop Protection Specialist (Olds)
Research Technician (Olds)

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Ms. Lorraine Kohlman
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Office Manager
Administration Support Staff
Administration Support Staff

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Ms. Joyce Brooks
Ms. Cathy Hendrickson
Ms. Bette Millar

FIELD CROPS BRANCH (continued)

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Supervisor, Forage Agronomy
Supervisor, Forage Crops
Supervisor, Cereal Crops
Supervisor, Special Crops
Supervisor, Oilseed Crops
Supervisor, Seed Technology
Supervisor, Range Management

Head, Crop Research Section
Plant Breeder
Research Agronomist
Supervisor, Farm Operations
Senior Research Technician
Senior Research Technician
Research Technician
Research Technician
Research Technician
Systems Analyst
Research Technician
Research Technician
Research Technician
Research Technician
Research, Equipment Maintenance
Research, Farm Worker

SOILS BRANCH

Branch Head
Office Manager
Word Processing Operator

Head, Soil Fertility Section
Research Agrolomist
Technologist, Soil Fertility
Technologist, Soil Fertility
Soils Specialist (Lethbridge)
Technologist (Lethbridge)

Head, Soil Improvement Section
Specialist, Organic Soil Management
Technologist, Soil Improvement
Technologist, Organic Soils

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Office Manager
Secretary
Data Entry Controller

Head, Laboratory Operations
Laboratory Agronomist
Soils Specialist
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Laboratory Technician
Laboratory Technician
Laboratory Supervisor
Laboratory Technician
Laboratory Technician
Laboratory Technician

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Ms. Shelley Eliuk
Ms. Penelope Chong
Ms. Chii-Guary Tsai
Mr. Gary Byman
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ALBERTA TREE NURSERY AND HORTICULTURE CENTRE

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Office Manager
Word Processor Operator
Administrative Secretary
Receptionist
Courier

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Ms. Linda Hansen
Ms. Pat Fulton
Ms. Helen Rekrut
Ms. Sharon Peterson
Ms. Vicki Noel

Head, Horticulture Crop
Development Section
Micropropagation Pathologist
Laboratory Technician
Vegetable Crop Specialist
Vegetable Technologist
Horticulture Extension Specialist
Horticulture Information Officer
Seed Potato Production Technician

Mr. James Letal

Dr. Piara Bains
Mr. Jamie Motta
Ms. Belinda Choban
Ms. Dominique Bizon
Ms. Betty Vladicka
Ms. Pam North
Mr. Bruce Chedzoy

Head, Protected Crop
Development Section
Tissue Culture Specialist
Laboratory Technologist

Dr. Mohyuddin Mirza

Mr. Kris Pruski
Mr. Muhammad Younus

Head, Nursery Crop
Development Section
Shelterbelt Production Specialist
Technician
Gardener
Gardener
Woody Plant Research Technologist
Gardener
Container Technologist
Gardener
Seed Technologist
Gardener
Chemical Application Technologist

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Ms. Vera Fialkowski
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Mr. Thean Pheh
Mr. Henry Brown
Ms. Cecilia McIsaac
Ms. Sophie Eckberg
Ms. Simone Dalpe
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Mr. Roy Marquardt

Farm Services Supervisor
Farm Services Foreman
Gardener
Mechanical Maintenance Chief
Auto Mechanic
Welder
Irrigation Technician

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Mr. Dave Wearmouth
Mr. Kevin Thorpe
Mr. Brian Petherbridge
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Mr. Gerhard Dames
Mr. Steve Milne

ALBERTA SPECIAL CROPS AND HORTICULTURAL RESEARCH CENTER

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Accountant	Ms. Anna Moeller
Librarian/Hostess	Ms. Joyce Clark
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Post-Harvest Specialist/Plant Pathologist	Dr. Jim Holley
Weed Control Specialist	Mr. Rudy Esau
Weed Control Technologist	Ms. Bernice Kruger
Entomology Technologist	Mr. Art Tellier
Food Processing and	Dr. Janet Panford
Quality Evaluation Specialist	
Food Processing Technician	Ms. Margaret Dench
Food Quality Technician	Mr. Joseph Hung
Diagnostician	Mr. David Kaminski
Section Secretary	Ms. Karen Chapman
Head, Horticultural Production Section	Mr. Clive Schaupmeyer
Potato Technologist	Ms. Cathy Feth
Vegetable Crops Research, Extension	Dr. Paul Ragan
Vegetable Crops Technologist	Mr. Mike Blades
Fruit Crops Research, Extension	Mr. Lloyd Hausher
Fruit Crops Technologist	Mr. Te-Sen (Peter) Pih
Nursery Crops Research, Extension	Dr. Mason Robertson
Ornamentals Technologist	Mr. Nigel Seymour
Protected Crops Research, Extension	Ms. Judith Butt
Research Crops Technologist	Mr. Murray Briant
Section Secretary	Ms. Mayumi Tanigami-Bunney
Head, Special Crops & Agronomy Section	Dr. Refe Gaudiel
Special Crops Technologist	Mr. Collin Wildschut
Research Agronomist, Field Crops	Mr. Henry Najda
Field Crops Technologist	Mr. Art Kruger
Research Agronomist, Soil and Water	Dr. Colin McKenzie
Soil and Water Technologist	Mr. Neil Clark
Section Secretary	Ms. Pat Maskaluk
Site Manager	Mr. Joe Chomistek
Farm Manager	Mr. Henry Christesen
Grounds Technologist	Mr. Greg Feth
Senior Mechanic	Mr. Roland Williams
Heavy Duty Mechanic	Mr. Barry Merkl
Farm Worker	Mr. William Wise
Farm Worker	Mr. Randy Hellmer
Stockkeeper/Safety Officer	Mr. Bill Coffey

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HIGHLIGHTS





HIGHLIGHTS

- Winter cereals continue to improve forage production in annual pastures. Seeding in the spring and intercropping with spring cereals is being adopted as a method of providing excellent silage as well as fall pasture on the winter cereal regrowth.
- Alberta Special Crops and Horticultural Research Center (ASCHRC) entered into an agreement to establish adaptability trials of perennial grasses for seed production in southern Alberta. It was agreed that ASCHRC would establish three irrigated test sites based in the major climatic zones of southern Alberta; the four grasses included Kentucky bluegrass, chewings fescue, tall fescue and perennial ryegrass. Information from these trials will indicate what grasses should be grown for seed under our conditions. There is substantial interest in this program especially from various seed companies in the U.S.
- Ten new canola varieties from both private and public plant breeding programs were registered and are providing improved quality, disease and yield benefits for Alberta farmers.
- Pedigreed seed acreage increased almost 10% to 263,824 acres in Alberta with 1,105 growers involved. This represents almost 20% of the Canadian total pedigreed acres.
- The hulless barley, Condor, released in 1988 is generating considerable interest from growers, livestock feeders and food processors. Considerable market development will ensure maximum use of this new barley type.
- Field Crops Branch recent release of a winter triticale "Pika" is generating considerable interest as a fodder when seeded with other spring cereals.
- All aspects of the horticulture industry had a productive and rewarding year. Seed potato production was up nearly 10,000 tonnes from a 10% increase in acreage. The greenhouse industry expanded into tree seedling growing on contracts through Alberta Forestry, Lands and Wildlife.
- The commercial vegetable industry held relatively stable with a 1% increase in acreage and dollar value. The Market Gardener acreage and dollar value held to previous figures. In total the commercial, market garden and processing industries did about 13.95 million dollars of business on approximately 4,130 ha. (10,200 acres).
- Herbs and spice development were actively pursued. Lemon Bergamont was identified as a potential crop for the production of "Thymol". A development agreement was signed with Purdue University to facilitate the development of a high methyl cinnamate basil, another crop with potential for Alberta.
- Fertilizer sales reached an all-time high. Alberta farmers purchased 987,000 tonnes of product during the fertilizer year ending June 30th or a 3.7% increase. More nitrogen, phosphate and potash were used in 1985 as large quantities of higher analysis fertilizers made up total sales. Less anhydrous ammonia (82% nitrogen) and more urea (46% nitrogen) was used in 1990. Since 1983, the ratio of nitrogen to phosphate has increased from 1.4 to one to 2.3 to one.
- Research continues to show that trees and shrubs used in shelterbelt and windbreak plantings reduce soil erosion and damage to buildings and equipment. Such plantings are environmentally compatible, provide protection for domesticated animals, and increase habitat for wildlife.
- A new program established by Crop Protection provided District Agriculturists with on-hands training in weed, insect, disease and vertebrate pest control. The training was held at Olds and the students learned to identify pests and pest damage, how to sample and use sampling tools. Diagnosis of pest damage and herbicide injury were included. Finally, the students were provided a set of sampling tools. This program was rated very highly and will be continued.

- A new Seed and Grain Diploma program was initiated at Olds College. Industry, Alberta Agriculture and Agriculture Canada are funding the two year initial diploma program.
- The Master Gardener Program developed through a pilot project and included training sessions. The first group will provide the nucleus for the continuation and expansion of the program throughout Alberta.
- New perennial forage varietal evaluation trials were seeded down at ten locations ranging from Lac La Biche to Brooks. These trials will provide the data necessary to issue the recommendations on adapted species to Alberta farmers and the forage industry.
- Ten forage associations received provincial grants totalling \$310,950. Intensive pasture management, fertility, species and varieties best adapted and hay marketing were all major extension topics. Hay production in Alberta for 1990 was estimated at 10.5 million tonnes, the most ever, and this production represented 29% of the total production for Canada. 1990 processed forage exports were estimated at 237,000 tons of alfalfa pellets, 20,000 tonnes of alfalfa cubes and 11,000 tones of densified hay.
- Two pulse crop varietal research plots were set up in central Alberta. These plots were used to conduct the foreign field pea and fababeen trials.
- Cereal and oilseed varieties were evaluated at 30 sites in the province. Data from these trials was used to compile Agdex 100/32, "Varieties of Cereal and Oilseed Crops for Alberta."
- A province wide barley and canola survey has been launched with over 1,000 participants. The data will be used for new extension material and for revising the barley and canola production manuals.
- Seventy-eight co-op seed cleaning plants processed 29 million bushels of cereals and oilseeds for the year ending June 30, 1990, for an average of 384,000 bushels per plant.
- Twenty-five of these municipal co-op plants received \$310,080 in grants (30% of actual cost) for upgrading facilities and equipment. A replacement plant was built at Boyle at a cost of \$1.1 million and the province provided \$400,000 towards this cost. The total volume processed by the 78 seed plants is sufficient to seed 75% of the seeded acres of cereals in the province.
- The Alberta Forage Seed Council entered into a new two year mandate and is reviewing the feasibility of a forage seed commission.
- A recent world trend indicates that two-row barleys are preferred in the international feed and grain markets. To accommodate this Field Crops Branch placed more emphasis on disease resistance of two-row barley types in their breeding program.
- Crop Protection Branch provided \$43,805 to pay fifty per cent of an assistance program for grasshopper control in the Special Areas.
- Weed resistance to herbicides was documented and studied at a number of Alberta sites. This phenomena has some very serious ramifications and provides additional incentive for exploring alternative methods of weed control.
- Rabies control work continued through maintenance of a buffer zone along the Saskatchewan and Montana borders to keep rabid animals from bringing the disease into Alberta.
- Alberta maintained it's rat free status primarily through publicity and operation of a buffer zone along the Saskatchewan border.
- Bacterial ring rot of potato was monitored in commercial fields and control is integrated with programs of other branches plus the Federal Government. The goal is complete eradication of the disease by 1993.

- The diffuse and spotted knapweed program has reduced the acreage of these weeds below 100 acres and follow-up is routinely conducted on scattered patches. Continued maintenance is required to prevent infestation from Montana and British Columbia where millions of acres of these weeds exist. The division goal is to complete the eradication of both species.
- Nodding thistle has been targeted for eradication and in the past year no new infestations were found.
- Blackleg of canola has spread beyond the point where eradication is possible, however, effort is being made to contain the disease to the east-central area and to check spread via infested seed. Crop rotation and continued vigilance are being promoted. This is an ongoing program and, while slow spread is being experienced, the program is buying time for breeders to develop resistant varieties.
- Dodder and yellow star thistle were elevated to the restricted category and they as well as purple loosestrife have been targeted for eradication. Yellow star thistle has not yet been reported in Alberta but is present in the nearby U.S.A.
- The Primocane (fall-bearing) raspberry cultivar "Fallbrook" developed by ASCHRC, outyielded other primocane cultivars. This type of raspberry allows canes to be mowed to the ground each year.
- Zucchini yellow mosaic, a new virus disease of greenhouse cucumbers was confirmed at four greenhouse operations.
- The Alberta Greenhouse Industry Assistance Program provided \$619,536 in grants to 74 producers.
- A grant of \$100,000 was provided to the Fruit Growers Society of Alberta to assist with the purchase of a saskatoon harvester.
- Alberta Tree Nursery and Horticulture Centre continued to privatize several production and service functions with an increasing number of greenhouse nuclear seed growers and a larger number of trees and shrubs for the shelterbelt program going out to tender. There has also been a move to contract out the growing of vegetable transplants required for demonstration and research projects.
- The tissue culture lab at the Alberta Tree Nursery and Horticulture Centre continued the production of saskatoon, sour cherries, chrysanthemums and other worthwhile crops.
- The Alberta Tree Nursery and Horticulture Centre supplied 1,000 wild rose and 500 trembling aspen seedlings to Alberta Road in Hokkaido, Japan. Demonstration shelterbelt planting accounted for a distribution of 27,000 plants. Over 1.3 million plants were distributed as free windbreak trees.
- Research continued on potato diseases that affect the seed growers, particularly black scurf and stem canker. A saskatoon disease that affects the industry severely, leaf and berry spot blight, was worked on. Vegetable cultivar evaluation took up most of the vegetable research time. Grower co-operative vegetable trials were increased into the Peace River and Red Deer areas. Greenhouse research continued on problems surrounding hydroponic vegetable growing and greenhouse cut flower production.
- Tissue culture research was expanded to include conifers. Autotrophic micropropagation was worked on in the lab. Research in woody plant testing continued with several recommendations being made from the Regional Woody Plant Test Program. Recording soil moisture and crop yields as affected by shelterbelts continued throughout the province.
- A cooperative research proposal involving the University of Alberta and Soils Branch to evaluate environmental effects of using phosphogypsum as a soil amendment was developed and a \$130,000 research grant for each of the next 5 years was obtained from Sherritt Gordon Ltd., Western Cooperative Fertilizer Ltd., Esso Chemical Canada and the Alberta Environmental Research Trust.

- Copper deficiency was identified as a factor causing decreased yield and quality of crops on up to 3 million acres of farmland in Alberta. Preliminary results from research trials show there is considerable variation in crop and varietal tolerance to copper deficiency. Yield increases from copper applications have ranged from 20 to 400 percent.
- The Soils Branch was able to expand its field research program with research grants provided by fertilizer manufacturers, producer organizations, Farming for the Future and the Alberta Agricultural Research Institute. In excess of \$250,000 in research grants were used to carry out fourteen field research projects related to crop nutrition and soil management.
- Laboratory services are an integral component of research programs. Farming for the Future, Alberta Agricultural Research Institute, Canada/Alberta Research and Technology Transfer, Canada/Alberta Soils Conservation Initiative funding for soil and crop management projects has contributed to increased sample volume. Research samples have increased to over two-thirds of the total number of soil and plant samples analyzed at the Soil and Animal Nutrition Laboratory.
- Two videos "How I Became a Soil Sampling Expert" and "Yield Signs: Recognizing Nutrient Deficiencies" were produced with help from the Soils Branch. These videos were funded by Sherritt Gordon Ltd., Norwest Soils Research Ltd., Alberta Wheat Pool, Esso Chemical Canada and Alberta Agriculture.
- A quarterly newsletter "SOILutions" was initiated to foster the transfer of information between researchers, agribusiness, producers and government personnel. Circulation of the newsletter is growing rapidly with very favourable response from a broad spectrum of readers.
- A number of Soils staff met with Esso Chemicals at their Redwater fertilizer plant. They proposed to develop an "expert" computer soil test recommendation program for their dealer network across western Canada. We will be providing our soil test recommendation equations and data for their use. We will also have the opportunity to verify their recommendation program and be able to purchase copies for use by regional and district offices.
- In 1989-90 the concept of supporting Applied Research Associations on a regional basis to fill some of the gaps in research which would be of most benefit to local needs was introduced. Chinook Applied Research Association (CARA) was identified as the first such organization able to qualify under the program. We therefore entered into a five year agreement with CARA in 1989/90. This year, to honor our second year of the agreement, CARA received \$100,000 under the Applied Research Association Program.

BRANCH ACTIVITIES





CROP PROTECTION BRANCH

SUMMARY

The mission and strategies of the Crop Protection Branch remained unchanged. The branch mission is "to protect Alberta's crops and agriculture from losses due to pests, through the development, implementation and adoption of economically justifiable, effective and environmentally sound pest management programs and strategies".

The Branch focuses on two major strategies:

- Keep Alberta free of specific pests by operating programs to exclude and/or eradicate these pests whenever this approach is both possible and practical.
- Reduce the damage done by pests in those instances where eradication or exclusion is impossible or impractical.

Crop Protection Branch had 26 permanent positions and 25 permanent employees (one vacancy has not been refilled). In addition the branch has one temporary salaried position and 6.8 wage person years.

The provincial rat control program is carried out with the assistance of five municipal inspectors under contract to the branch. Intimate co-operation and co-ordination with staff at the Alberta Environmental Centre in Vegreville continued as in previous years.

BRANCH ACTIVITIES

Most crop pests in Alberta consist of weed infestations which are well entrenched, insect populations which are highly mobile and move into Alberta when weather conditions favour spread, and native or introduced plant diseases. Some insects overwinter in Alberta and reach outbreak proportions occasionally (usually in a cyclical manner). Because eradication is unlikely, the Branch focuses on mitigation of damage:

- Predator control upon evidence of livestock predation and extension effort aimed at improving management to prevent damage.
- Research to extend the range of pest species controlled by common pesticides or to extend the range of crops which may be treated (Minor Use of Pesticides Program).
- Development and dispersal of biological control agents.
- Research to assist in development of disease and insect resistant crop varieties.
- Recommendations regarding agronomic practices to avoid pest build up or to reduce pest levels.
- Creation of extension material giving advice on pest control measures, training programs for staff and producers.
- Monitoring and forecast programs, development of field scouting techniques and identification of threshold levels for many pest species.
- Administration of legislation designed to protect producers against the spread of weeds and pests and to protect farmland from severe infestations or the spread of pests.
- Maintenance of records and histories on pest problems.
- Development and implementation of specific and general plans to prevent pest build up, identify control strategies, co-ordinate control efforts and monitor any side effects.
- Providing specific advice to producers and extension staff on a consultative basis.
- Co-ordinate programs and information with other provinces and the Federal Government.

PROBLEM WILDLIFE, PLANT PATHOLOGY AND APICULTURE SECTION

Problem Wildlife

The Problem Wildlife Section was involved in three programs: rat control, rabies suppression in skunks, and prevention and control of coyote depredation of livestock. Responsibility for prevention and control of wildlife depredation of crops and livestock is in co-operation with the producer, with assistance from the Municipal Agricultural Service Boards. Extension services were provided for the prevention and control of crop damage from rodents (primarily pocket gophers and Richardson's ground squirrels), nuisance birds (primarily magpies, blackbirds, sparrows and pigeons) and other mammals that conflict with human interests (bats, rabbits, porcupines, and squirrels). Field trials were conducted in co-operation with other agencies and private industry to approve registration of a new field rodent control product in Canada.

a. Coyote Damage Control Program

The primary objective of the coyote damage control program is to minimize livestock losses by providing advice, training, resources and assistance to farmers. The program is structured so farmers can solve predation problems with guidance and help from municipal and department personnel.

The branch is striving to foster an integrated and balanced approach to livestock predation control by incorporating non-lethal prevention and management measures with traditional lethal coyote controls. Farmers are expected to take a more co-operative role and share in the management of livestock predation, making greater use of non-lethal prevention control measures. Many local producer meetings were held throughout the province by problem wildlife staff to help inform farmers on the ways and means of solving coyote problems.

The program operates at the municipal level through the agricultural service board. The first avenue of help for a farmer with coyote problems is through their municipal agricultural fieldman. Problem wildlife specialists train and provide direct guidance and support to agricultural fieldmen. They also work co-operatively with agricultural fieldmen and farmers to resolve coyote predation and to develop strategies of predation management for individual farmers.

Predation prevention measures are promoted, especially for cattle producers at calving time and for sheep producers with persistent coyote predation. Shooting, proper carrion disposal and fence maintenance, night confinement of sheep, close supervision of expectant livestock and young, and confinement of poultry are practices emphasized to prevent and discourage predation problems. Electric fences and livestock guarding animals have proven effective in many situations and are used throughout North America. Many Alberta sheep farmers have built electric fences for predator control. Of 23 sheep farmers surveyed in 1989, 21 rated their electric fence good to excellent for predator control.

Two demonstration electric fences equipped with state-of-the-art equipment and technology were constructed at Olds College in 1989. These fences are used to train farmers and others in preventing coyote predation.

The Crop Protection Branch purchased and placed four guardian dogs and two guardian donkeys on farms that had previously experienced predation, to assess and demonstrate their effectiveness at prevention. One guardian dog died, but the others performed very well. This has led to increased interest and use of guardian animals by other farmers.

The coyote damage control program continued to rely on removal of problem coyotes with poisons and neck snares. Safety, correct placement and judicious use of these devices were emphasized to protect the user, other humans and non-target animals.

The department advocates selective and limited use of lethal devices to destroy coyotes, integrated with use of non-lethal predation control measures.

Toxicant use increased dramatically this year in correlation with increased complaints of coyote predation and harassment of livestock (Table I). Coyote numbers were at record high levels throughout the province. A depressed fur market and low coyote pelt prices have drastically reduced coyote harvest by trappers. The normal average Alberta coyote pelt harvest is 30,000 per year, with 1990 harvest estimates at below 10,000 coyotes. Successive mild winters and low incidence of coyote mange has also complemented coyote survival. The production and supply of strychnine tablets was discontinued in 1990. Strychnine tablet use declined, with municipal inspectors using any remaining supplies on hand. Sodium monofluoroacetate tablets (Compound 1080) were the principle device used to remove problem coyotes. Each tablet contains 5mg of compound 1080, enough to kill one coyote. Most tablets were applied within small baits placed in the vicinity of a livestock predation site. Applied in this manner, compound 1080 is target specific to canids. It is also less hazardous to other wildlife, humans and domestic animals than other poisons.

Table I: Toxicants and Devices Used For Coyote Control					
Year	Cyanide Shells	Strychnine Cubes	Single Dose 1080	Snares	Total Units
1984	1,175	4,184	147	----	5,506
1985	873	2,609	346	----	3,828
1986	482	2,166	558	1,143	4,349
1987	565	1,567	1,769	933	4,834
1988	696	1,285	2,658	114	4,753
1989	481	1,493	3,161	131	5,266
1990	574	927	6,824	166	8,491
* The use of large multi-dose 1080 baits, set in winter for population reduction of coyotes, was discontinued in 1989.					

The number of predation complaints investigated by problem wildlife staff increased from 190 in 1989 to 221 in 1990. Most of the predation complaints received were referred to agricultural fieldmen and in most cases, staff investigations were in response to agricultural fieldmen requests for assistance or follow-up on farmer consultations. The investigations carried out mostly involved coyote predation of sheep and young calves. (Table II).

Table II: Number of Predator Complaints Investigated by Wildlife Staff, 1990

	Sheep	Cattle	Hogs	Poultry	Other	Cases
Coyote	94	97	3	7	9(b)	210
Dog	2	0	0	0	0	2
Other	1(bear)	1(bear)	0	6(a)	1	9
TOTALS	97	98	3	13	10	221

(a) 3 fox 3, raccoon

(b) 3 gamefarm, 3 goats, 1 rabbit, 1 nursery, 1 dog

The number of coyote complaints handled by agricultural fieldmen continued to increase as did the amount of toxicant used for coyote control (Table III). Municipal agricultural fieldmen now respond to the majority of complaints.

Table III: Toxicants Used For Coyote Control By Agricultural Fieldmen, Jan. 1 - Dec. 31

Year	Cases (Clients)	Toxicants Used	Toxicants/Case (Clients)
1984	520	4,125	7.9
1985	528	2,933	5.6
1986	398	1,945	4.9
1987	513	2,530	4.9
1988	619	3,453	5.5
1989	706	4,090	5.8
1990	1,108 (696)	6,736	6.1 (9.7)

b. Rat Control

The Norway rat control program successfully completed its 40th consecutive year of keeping rats out of the province. Control of rat movement was confined to and contained within the 600 km long and 30 km wide rat control zone, along the Alberta-Saskatchewan border, from Montana to Cold Lake. The provincial program operates cooperatively with seven municipalities within the rat control area.

Periods of prolonged cold weather over several months and available fresh rat bait, contributed toward the prevention and elimination of rat infestations within the province. The use of dry, cereal, warfarin bait, and water soluble warfarin bait increased this year due to an intensive prebaiting program in the County of Vermilion River. The use of single dose baits and paraffinized bait blocks also increased.

Rat infestations in Vermilion River County have remained static at higher than ideal levels for the past several years in spite of intensive repetitive inspection and immediate and thorough control and eradication action. Because no consistent pattern or distribution of rat infestations was apparent, it was decided to take action before

rats were reported or discovered. This involved the placement of rat bait at all possible inspection sites and particularly those sites with several habitat opportunities for Norway rats. This effort resulted in the issuance of an additional 8,000 units of rat bait.

Pest Control Inspectors gave bait to farmers, with instructions for placement, or (if the landowner was not present) the bait was left on the premises with written instructions. In all cases an accompanying letter, addressed to the landowner, explaining the pre-baiting initiative was included. All rat-bait provided to farmers, was delivered in a poly carrying bag with appropriate, descriptive instructions and warning decals.

Results of the prebaiting program will not be known for at least one year. However, a trend or indicator of success should be apparent during the regular 1991-1992 inspection season.

All inspection and control work for Special Areas #2, 3, and 4 and the M.D. of Acadia Valley are conducted by Alberta Agriculture's Problem Wildlife Specialist at Oyen. The municipalities of Vermilion River and Wainwright continue to conduct inspections and rat control in Saskatchewan. Data in (Table IV) excludes the number of inspections conducted in Saskatchewan but does include all bait set out or issued to farmers.

Table IV: Norway Rat Control on the Alberta - Saskatchewan Border 1990 - 1991

Municipality	Person Years	Bait Used		No. of Premises Inspected	Infestations		
		Dry (units)	Water Soluble		1988	1989	1990
Bonnyville	0.5	647	89	1,447	0	0	0
Vermilion River	1.7	16,578	296	3,003	43	34	26
Wainwright	1.0	2,142	60	683	2	1	0
Provost	1.0	4,340	422	1,588	19	7	4
Special Areas	1.0	2,397	123	882	9	0	2
Cypress	0.5	1,619	0	218	0	0	0
TOTAL	5.7	27,723	990	7,821	73	42	32

Bait type and container size varied this year. Rolled oats plus warfarin (anticoagulant) bait was packaged in 340 gram bags. Ramex (diphacinone) whole grain bait was packaged in 200 gram containers. Pest control inspectors and farmers found these containers convenient to use and more versatile than the larger, bulkier bags. "Second generation" rat baits (brodifacoum, bromodialone) are formulated in 100 gram containers. The smaller containers of second generation baits were designed for safety reasons (to non targets) and because rats need only a single feed to produce death.

As a result of several confirmed Norway rat sightings in urban centers, the branch identified the need for a strategy to deal with a major infestation of rats in urban areas. An urban rat control response plan was developed to outline the roles of all agencies and personnel (presently or otherwise) that would be involved in eradication of an infestation. Contact, consensus, and agreement with the various participants of the response plan will be continued in 1991-1992.

c. Rabies Vector Control

During the 1990 calendar year, a total of 42 cases of rabies were diagnosed in Alberta; 25 skunks, 12 bats, 3 cats, 1 dog and 1 pig.

Since skunks are the primary host and reservoir of this Province's rabies infection, it is comforting to note only two municipalities, both in southern Alberta, had skunks diagnosed with rabies in 1990. The Municipal District of Cardston had 14 cases of skunk diagnosed, all in the Magrath-Welling area; the County of Warner, 11 cases;

the Coutts area, 1 case; and in the Raymond-Welling area, 10 cases. Other municipalities commonly prone to skunk rabies (Forty-Mile, Newell, and Cypress) were rabies-free in 1990.

Control of skunk rabies consisted of radial depopulation within rabies positive sites, border skunk depopulation (adjacent to Montana and southern Saskatchewan), and skunk sampling in previous rabies locations.

The first radial depopulation was initiated northeast of Coutts after a domestic pig became infected with rabies. Samples were difficult to obtain as this area was part of our on-going border skunk control. Eight skunks were removed, 7 submitted for diagnosis and 1 confirmed with rabies. The depopulation effort encompassed roughly 10 radial kilometers and required one-half man-months to complete.

The second radial depopulation encompassed 9 townships within the Raymond-Magrath area, and required over 5 man-months of effort to complete. In total, 554 skunks were removed, 324 submitted to the Animal Disease Research Institute for testing, with 24 confirmed as having rabies. Provincial and municipal control staff accounted for collecting and submitting 20 rabid skunks (83%) from this area. This depopulation area was larger than the routine 5 radial kilometers, but necessary due to:

- a. the unusually high numbers of skunk rabies originating in the area,
- b. the distance between initial positive skunk samples was over 15 kilometers, and
- c. there were 9 cases of skunk rabies diagnosed within the same geographic area during the previous year.

The third radial depopulation was more of a skunk sampling program, in response to a rabid dog near St. Albert, north of Edmonton. Twelve skunks and 3 feral cats were removed and submitted for analysis, with all submissions testing negative. This sample represented a significant percentage of the existing skunk population in a 2 kilometer radius. All animals were live trapped at farmsteads, with no toxicants used. Control efforts required 1 man-month to complete.

The southern border control zone adjacent to Montana was depopulated from Cardston east to Aden. In total, 168 skunks were removed with 135 submitted for testing; all tested negative. This depopulation zone is roughly 160 kilometers long and 10 kilometers wide; 2 man-months were required to complete. Control work was undertaken from September to November.

The eastern border control zone adjacent to Saskatchewan was depopulated from the Cypress Hills area to the South Saskatchewan River within the Municipal District of Cypress. In total, 55 skunks were removed, 18 submitted for rabies testing with no confirmed cases reported. Skunk populations remain consistently low along this eastern border which is roughly 130 kilometers long and 29 kilometers wide. Control required 3 man-months to complete.

In total, 2,496 strychnine egg baits were placed at over 900 poison sites, commonly in small roadside culverts or under abandoned farm buildings. Rabies control efforts which included trapping, shooting, and poisoning, accounted for removal of an estimated 819 skunks. Of these, 693 (85%) were taken by poison egg baits. Non-target animals removed by poison baits included: 5 badgers, 3 foxes, and 1 raccoon; for a total of 9 cases. All trapping was undertaken using live-traps, which have the ability to safely release non-target animals.

Of concern, is the fact that nearly 100 raccoons were captured during the skunk removal efforts in the Raymond-Magrath area. Although no Alberta raccoon has ever been diagnosed with rabies, neighboring Montana and Saskatchewan have a combined confirmed total of 11 cases of raccoon rabies within the past six years (Montana - 9 cases, Saskatchewan - 2 cases).

Rabies antibody testing was also initiated this summer, using blood samples from 141 skunks out of the Raymond-Magrath area. All blood samples, including 3 from skunks with confirmed rabies, did not exhibit any rabies antibodies.

In comparison, (Figure 1), the Province of Saskatchewan received a total of 55 confirmed rabies cases for 1990 including 34 skunks, 10 bats, 6 cats, 2 horses and 3 bovine. This is the lowest incidence of rabies recorded for this province since the last decade.

In the State of Montana, confirmed rabies cases reached 45 for 1990, including 26 skunks, 16 bats and 3 bovine. As well, the 1990 rabies total in Montana has been the lowest incidence since the last decade. Figures 2 and 3 compare the incidence of rabies in skunks and domestic animals from 1980 though 1990 for Alberta, Saskatchewan and Montana.

Figure 1: Alberta, Saskatchewan, and Montana Comparison of Rabies Cases, 1990

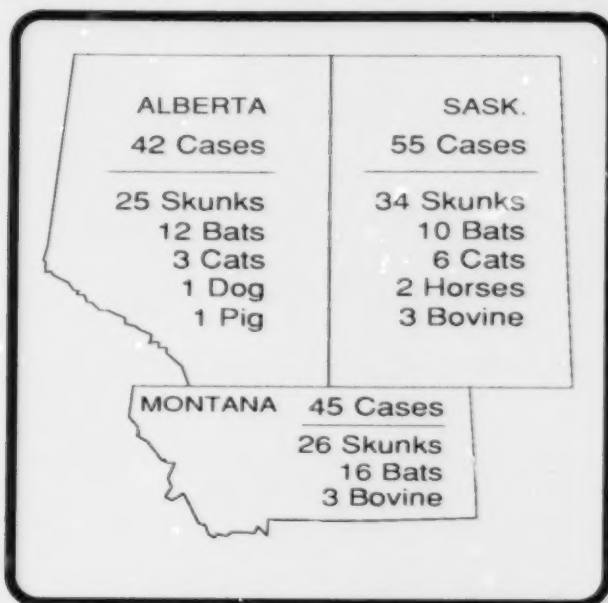


Figure 2: 1980 - 1990 Total Rabies Comparison - Alberta, Saskatchewan and Montana

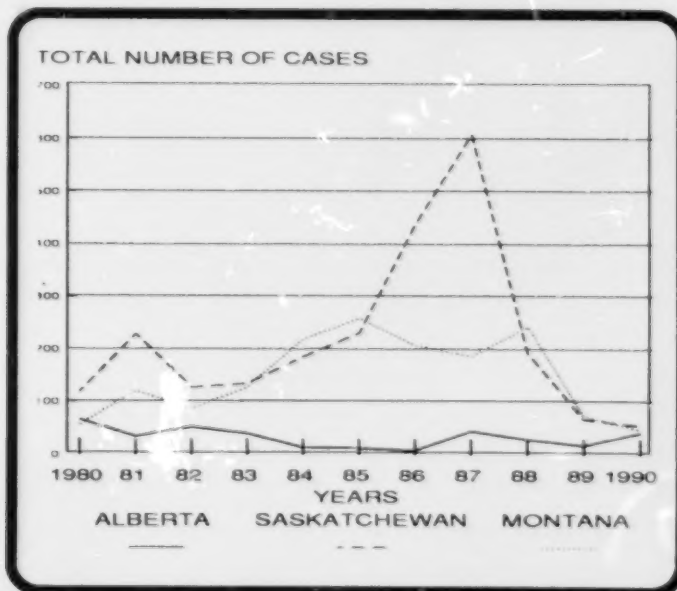
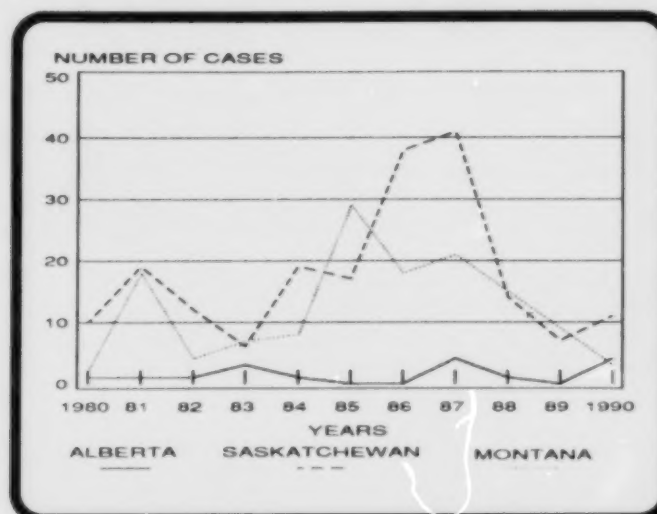


Figure 3: 1980 - 1990 Domestic Rabies Comparison - Alberta, Saskatchewan and Montana



Apiculture

People who own beekeeping equipment or honey bees are required to annually register the number of colonies they own and the apiary sites where the bees are located. (Tables V, VI and Figures 4 and 5 summarize this data.)

Table V: Number of Beekeepers & Colonies 1989 and 1990
(as of October 31 1990)

Region	1989		1990	
	Beekeepers	Colonies	Beekeepers	Colonies
N R	8	1,466	9	1,645
1	55	31,109	61	27,672
2	113	11,338	111	10,335
3	111	8,076	98	6,854
4	78	17,745	74	14,471
5	281	46,329	278	49,680
6	125	46,393	134	46,050
TOTALS	771	162,456	765	156,705

NR * means non-resident beekeepers who spend the summer in Alberta

Table VI: Beehives operated by Regions

Size of Operation	Beehives per Region							Total Beehives
	0	1	2	3	4	5	6	
1-50	45	429	727	432	320	1,584	500	4,037
51-100	100	69	310	154	329	1,028	789	2,779
101-200		160	450	558	853	2,450	1,303	5,772
201-600		2,143	2,635	3,160	2,416	11,764	10,173	32,291
601-1,250		4,660	912	2,550	3,472	11,977	15,885	39,456
1,251-2,000	1,500	6,411	1,500		2,611	7,257	8,600	27,879
2001+		13,800	3,800		4,770	13,620	8,800	44,490

Figure 4: Number of Registered Beekeepers

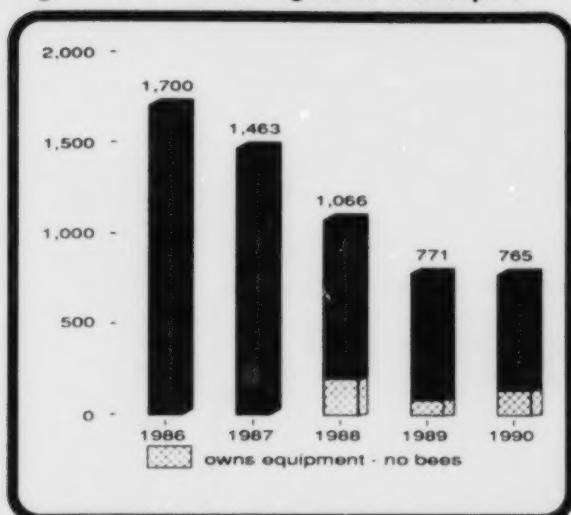
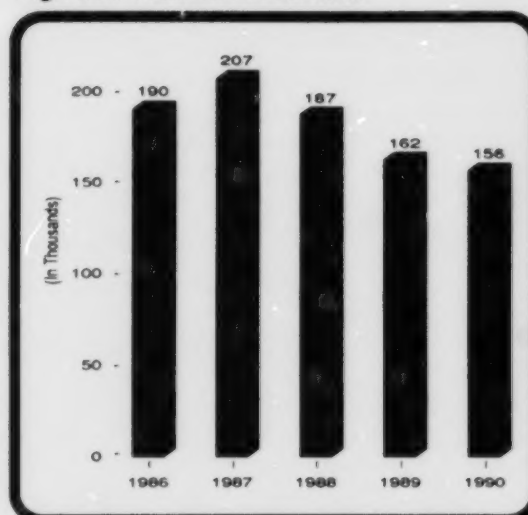


Figure 5: Number of Colonies



Since 1987, several factors have influenced the number of beekeepers and colonies in Alberta. These economic and production factors include:

- The discovery of varroa mites in the United States and the consequent closure of the United States border for the importation of honey bees into Canada.
- A period of depressed returns for honey crops.
- A forced change in management from packages each year to overwintering colonies.
- A reduction of available operating credit due to declining revenues and declining equity value of beekeeping equipment.

These factors have caused some commercial beekeepers to leave the industry and others to reduce their operations. Also large numbers of hobbyist beekeepers have ceased operations. The number of registered beekeepers that operated colonies in 1988 were 870; 1989, 678 and in 1990, 638.

a. Alberta Honey Production 1989

Most of the province experienced weather patterns favorable for nectar secretions leading to a crop close to the ten year average. Honey production in 1990 was approximately 11,000 tonnes, up about 3,000 tonnes from the 1989 crop (Figure 6). Average colony yield increased 16 kg per colony to 71 kg. (Figure 7).

**Figure 6: Alberta Honey Production
(Thousands of Tonnes)**

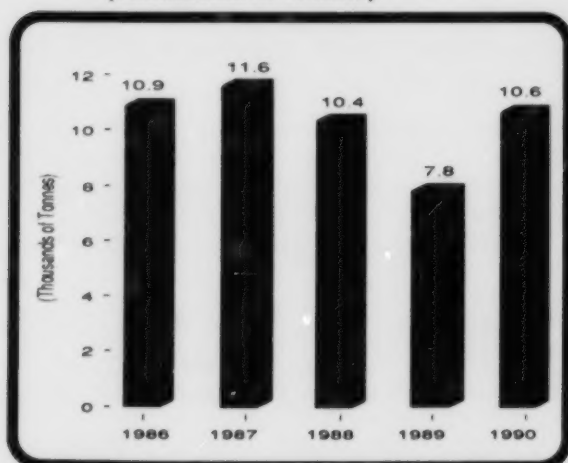
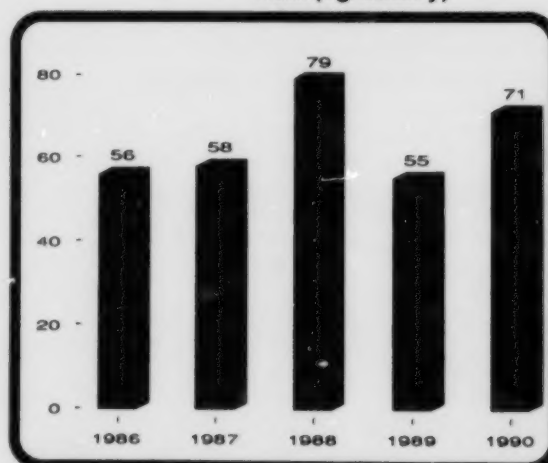


**Figure 7: Alberta Average Honey
Yield (kg/Colony)**



b. Apiculture Inspections and Surveys

During the 1990 inspection season, (April 1 to September 30), the Apiculture Section employed six part-time field inspectors on wages and the services of two laboratories.

A total of 840 colonies and 3,966 brood chambers were inspected for honey bee diseases in 46 beekeeping operations in 1990. American Foulbrood disease was detected in 9 (21%) operations in a total of 51 colonies. A total of 3,966 brood chambers were examined for sale authorization. American Foulbrood was detected in 413 supers of brood comb (10.4%) in 5 beekeeping operations. There were no reports of European Foulbrood, Chalkbrood or Sacbrood diseases. (Table VII).

Table VII: Apiculture Inspections, 1990			
Region	Operations	Hives Inspected	American Foulbrood + Operations
1	3	135	--
2	6	52	1
3	5	1	--
4	2	53	--
5	4	126	3
6	26	473	5
Totals	46	840	9

Tracheal Mite Surveys - During 1990 samples were collected from beehives across the province to be tested for tracheal mites. In addition, a number of beekeepers collected their own samples for testing.

In the spring, samples were taken from eight beekeeping operations and 6,950 individual bees were examined. Two of the eight operations were found to be infested with tracheal mites.

In the early fall, samples were collected for tracheal mite analysis from ten beekeeping operations so that colonies of bees could be moved to British Columbia for the winter.

During this program 19,940 bees were analyzed from 175 samples taken from 6,809 colonies of bees. Colonies of bees were found positive for tracheal mites in three of the operations. The hives located in the apiaries containing the infested bees were not allowed to move to British Columbia.

Tracheal Mite Testing Program - Alberta Agriculture assisted resident beekeepers who wanted to have samples of bees tested for tracheal mites to aid their management decision making. The assistance was \$0.10 per bee tested (approximately 1/3 of the total cost).

Also during the fall of 1990, a province wide random survey of 38 commercial beekeepers collected 996 samples of bees to be tested for tracheal mites. The examination of 16,146 bees showed that 12 of the operations had some hives infested with tracheal mites.

During the year at least eight beekeepers collected samples privately and submitted them for analysis. Two of these beekeepers were determined to have tracheal mites.

After all of these samplings and results from previous years, 26 of the beekeeping operations in Alberta have been determined to have tracheal mites at one time or another. These operations are located in several areas across the province.

Varroa Mite Surveys - Agriculture Canada surveyed 72 hives with fluvalinate strips. The majority of these hives were along the United States border but others were deeper within the province.

The alcohol from most of the samples of bees collected by Alberta Agriculture during the tracheal mite surveys were examined for varroa mites.

No varroa mites have been discovered in Alberta.

c. Overwintering Bees

During the past two decades Alberta beekeepers had been gradually increasing their interest and commitment to overwintering bees. Systems were developed to overwinter bees in British Columbia, on site in Alberta or within buildings in Alberta. Table VIII provides wintering statistics for the years 1987-1990.

Table VIII: Wintering Statistics 1987, 1988, 1989, 1990				
Year	Colonies Operated	Colonies Wintered	% of Colonies	Winter Mortality %
1987-1988	190,000	122,000	64	15
1988-1989	187,000	151,000	80	30
1989-1990	162,000	151,000	93	16
1990-1991	154,000	150,000	93	12 (est)

The closing of the Canada-United States border to U.S. package bees accelerated this interest and commitment. Based on experiences elsewhere, tracheal mites will severely impact the successful wintering of honeybees in Alberta. So far, this has not occurred.

National Tripartite Stabilization Plan - This joint Federal, Provincial, industry program continued with most of Alberta's commercial beekeepers participating. A payout of \$.0478 per pound was made for the 1989 crop.

Alberta Hail and Crop Insurance Corporation - This joint Federal, Provincial, industry program continued to protect 60 Alberta beekeepers from losses due to poor honey yields compared to their long-term average yield.

Plant Pathology

a. Bacterial Ring Rot Program (BRR)

Grower records were obtained via the Alberta Potato Marketing Board (APMB) and forwarded to the appropriate co-operating municipalities for bacterial ring rot inspection.

In 1989, only one grower in Alberta had potatoes with a trace of bacterial ring rot in 260 acres. Unfortunately in 1990, this soared to 13 growers with 641 acres infested with Bacterial Ring Rot. These producers grew 5,128 acres of potatoes on their farms. Total commercial acres grown in Alberta in 1990 was 21,768 acres of which 20,826 were inspected. Eleven of the 14 infestations on 13 farms originated with certified sources of Sangre or contact of other cultivars with the infected Sangre source. Only three Bacterial Ring Rot infestations occurred independently of this source. (Table IX).

Alberta potato growers at their annual general meeting at Lethbridge in November, 1990 passed a resolution requesting that a law be passed requiring all potatoes planted in Alberta subsequent to the 1991 growing season be certified or better grade. Crop Protection Branch personnel in conjunction with the Alberta Potato Industry is in the process of drafting a regulation to this end.

Table IX: Potato Acreage and Incidence of Bacterial Ring Rot in Alberta

District	Number of Farms		Number of Acreages	
	Inspected	Infested	Inspected	Infested
Co. of Newell #4	11	3	2,487.0	131
M.D. of Cypress #1	1	0	80.0	0
M.D. of Taber #14	35	5	13,529.0	350
Co. of Forty Mile #8	3	2	1,108.0	105
Co. of Lethbridge #26	5	0	856.5	0
Lethbridge Perimeter	3	0	21.7	0
Region 2	7	0	193.5	0
Region 3	7	0	235.6	0
Region 4	5	1	148.0	15
Region 5	2	0	66.0	0
Co. of Sturgeon #90	8	2	1,602.5	40
Co. of Parkland #31	1	0	198.0	0
Edmonton Perimeter	3	0	161.0	0
Region 6	4	0	130.0	0
Totals	95	13	20,826.8	641

b. Blackleg of Canola

A third annual province-wide survey for virulent blackleg (*Leptosphaeria maculans*) of canola was carried out in July and August of 1990 with the co-operation of provincial/municipal fieldmen and Agriculture Canada seed inspectors with diagnostic assistance from plant pathologists at Brooks, Fairview and Vegreville. (Table X)

Table X: Blackleg of Canola Survey in Alberta - 1990
Municipalities with Confirmed Virulent Blackleg of Canola

Municipality			Number of Fields Surveyed	Number of Fields with Virulent Blackleg
East	Central	Alberta		
Co. of Thorhild #7			14	2
Co. of Paintearth #18			16	7
Co. of Flagstaff #29			101	23
Co. of Beaver #9			25	7
Co. of Smoky Lake #13			8	1
Co. of Vermilion River #24			31	9
Co. of Minburn #27			36	11
M.D. of Provost #52			40	22
M.D. of Wainwright #61			17	2
M.D. of Wetaskiwin #10			5	1
Total			293	85

The survey was based on inspecting a minimum of one commercial field for every 2,000 ha of canola in Alberta. Fieldmen surveyed producers who grew canola on short rotations or followed canola with canola. Blackleg was not found in Regions 1, 2 or 6. In the Edmonton area the nearest infestations occurred at Thorhild and east of Wetaskiwin.

Near Vegreville and Vermilion, one in three fields were blackleg infested; up to 50% of fields were infested near Provost. Main stem infection levels in affected canola crops ranged from trace levels to 10% infection. Two reports were received of fields with around 90% infection. Both fields were grown on canola stubble.

In total, 1,667 fields, including 595 pedigreed fields were surveyed for blackleg in 1990.

A follow up of the 60 growers who had blackleg confirmed on their land in 1989 showed that all had followed recommended rotations and achieved absolute mustard weed and volunteer canola control. Again, overall losses from virulent blackleg in Alberta this year were minimal and probably less than 1%. Federal seed inspectors checked 595 seed fields province wide and only three fields in Vermilion River County were found to have virulent blackleg infected canola. A total of 1,261 samples of which only two samples were positive were processed by commercial laboratories (Table XI).

**Table XI: Blackleg Testing of Alberta Canola Seed
- Final Results -
(Intended for Planting in 1990)**

	Number of Samples	Virulent *	Negative
Alberta Wheat Pool	362	1	361
20/20 Seed Lab	279	0	279
Newfield Seed Lab	218	1	217
Norwest Labs	322	0	322
United Grain Growers	80	0	80
Total	1,261	2	1,259

*Two virulent samples, one from seed grown in Ontario, another from a seed grower near Vermilion.

The first \$20 cost of testing each sample was paid for by Alberta Agriculture.

c. Diseases of Cereals

In early June 1990, cold soils, low nitrogen levels and wet, humid growing conditions in many areas of the province contributed to significant yellowing of barley and wheat crops. Scald and net blotch showed on barley at significant levels by early June. Hot dry weather in late June and early July, except for the wetter Red Deer - Olds area, slowed down or stopped foliar disease development. By late August, prior to swathing, most cereal crops were of good quality. Good weather conditions during harvesting, allowed most producers to harvest quality crops.

Copper deficiency symptoms, particularly in wheat were prevalent province wide especially on sandy-type soils. Melanosis, dwarfing and lodging of copper deficient wheat, associated with ergot infection, was evident from Rimbey to Lloydminster. Ergots were not found in wheat, barley or oats in any areas that could not be associated with copper deficiency. Further, herbicide interactions resulted in pronounced stunting and melanosis, particularly on sandy copper deficient soils found in central areas of the province.

Bacterial blight, a bright yellow streaking of the upper leaves, was common on barley, particularly Jackson. This disease, favoured by wet springs, along with fungus stripe and loose smut likely reduced barley yields by 5 to 20% in west central areas of Alberta.

Manganese deficiency (grey speck of cereals) showed up in west central Alberta on oats and in southern Alberta (Fort McLeod) on Harrington barley. The oat cultivar trial at the University of Alberta, Ellerslie Farm showed a striking range of reactions to available manganese in the soil. Cultivars such as Calibre and Waldren showed little or no damage, whereas Jasper and Salo were severely damaged with up to 70% of the seedling leaf area destroyed. In southern Alberta, considerable numbers of Harrington barley fields turned a distinct chlorotic yellow by early July. Manganese deficiency was diagnosed in these alkaline soils which "disappeared" with heavy rains in late July when the newer foliage greened up.

Take-all was severe province wide in wheat, particularly on the sandier soils and wetter regions of the province. The cultivars Oslo and Roblin were judged as unusually susceptible with root rot damage ratings frequently in the 20 to 40% range. In similar field situations, Conway, Katepewa, Neepawa and Park showed much less disease.

d. Diseases of Oilseeds

Cold dry soils in May and June resulted in seedling blight of some areas, but damage was not extensive. In east central Alberta, late seeding in mid-June and very dry soil conditions resulted in some excellent canola stands.

Heavy rains in late June flooded considerable acreages of canola from Red Deer to Olds resulting in root damage and poor stands.

Staghead was evident on newer cultivars such as Horizon and Colt where levels ranged up to 5%. This disease is suspected as more conspicuous than damaging to the canola crop.

Herbicide injuries to canola, in a number of instances, were correlated with Ally applied the previous year. Symptoms were evident in the form of weak, thin, "rubbery" stems that caused plants to grow a "whorl" shape.

Conditions for high levels of sclerotinia white stem rot spores were ideal in late June and early July due to moist surface soil conditions. An estimated 150,000 acres of canola were treated with Benlate or Rovral for control of this disease. The dry conditions that prevailed in mid-July were unfavourable for disease development and as a consequence, sclerotinia infection levels were lower than expected, but nevertheless 15 to 20% stem infections were common province wide, with occasional fields as high as 50%.

Province wide, alternaria blackspot pod infection was down from 1989 levels. Favourable harvest weather resulted in good seed quality with infection down considerably from the 15 to 20% levels of 1989.

Sulphur deficiency problems were low this year compared to 1989 and suggest that growers have followed sulphur fertilizer recommendations. Minor diseases such as gray stem and avirulent blackleg were uncommon except in the "wetter" Olds region. Adult flea beetles were observed in heavy numbers in August, on late maturing canola in the Lloydminster and Strathcona areas. Colorado potato beetles occurred in huge numbers in central and eastern Alberta in late July feeding on wild tomato infestations in canola fields. This suggests that potato beetles could be developed as a biological control for wild tomatoes.

e. Fairview Regional Crops Laboratory

Field crops specimens comprised 39% of the 145 specimens submitted in 1990. Commercial crop specimens totalled 67 or 46% of all specimens received in the laboratory (Table XII).

Table XII: Summary of specimens submitted to the Fairview Regional Crops laboratory in 1989 and 1990					
Crop	Category	Number of Disease Specimens		Number of Insect Specimens	
		1989	1990	1989	1990
Field crops		60	43	19	13
Vegetables		16	10	4	0
Ornamentals		29	42	1	13
Shelterbelts		0	2	3	5
Fruits		0	5	4	0
Stored Products		-	-	14	17
Miscellaneous		5	9	23	24
Total		110	111	68	72

Disease Survey - A disease survey was conducted on 78 canola fields in the 10 crop districts of Region 6 (Table XIII). The root rot complex was the most prevalent disease and affected 100% of the fields surveyed. *Alternaria* black spot was common with 95% of fields infested. Prevalence of *Sclerotinia* stem rot was low due to extremely dry weather after flowering, with 41% of fields infested and 10% of plants infected. No virulent blackleg was found. Other diseases observed were grey stem, white rust (staghead), sulphur deficiency, herbicide damage, pod drop from drought stress and sooty mold. Insect damage from maggots, lygus bugs, bertha army worms, diamond back moth larvae and cut worms were also observed.

Table XIII: Prevalence and Incidence of Root Rot, Foot Rot, Sclerotinia Stem Rot, Blackleg Spot of Canola in the Peace River Region in 1990

Disease		Prevalence (% fields infested)	Incidence (% plants infected)
Root Rot	<i>(Rhizoctonia, Pythium, Fusarium)</i>	100	96.4
Black Spot	<i>(Alternaria spp.)</i>	95	32.3
Foot Rot	<i>(Rhizoctonia, Fusarium)</i>	92	34.0
Stem Rot	<i>(Sclerotinia Sclerotiorum)</i>	41	9.6
Avirulent Blackleg	<i>(Leptosphaeria maculans)</i>	38	4.3

f. Research Projects

Root Rot and Root Maggot Damage on Tobin and the New Polish Variety Parkland - Since many new canola varieties will be registered in the next few years, it is important to determine the regional adaptation of these new canola varieties and monitor their disease level responses.

The varieties, Parkland and Tobin were seeded on May 23. The plots were replicated four times. Fertilizer was added according to recommendations from the soil test results. Emergence counts were taken on May 23. Plants were sampled by removing 10 plants at random from each plot and assessing root damage severity.

Root rot damage was severe on both Tobin and Parkland with an average rating of 2.9 for Tobin and 3.4 for Parkland. On average, Parkland had higher levels of root rot than Tobin. Root maggot damage was moderate with ratings of 1.6 for Tobin which was slightly higher than Parkland with ratings of 1.3. Both Tobin and Parkland are susceptible to root rot and root maggot infestations.

Tobin plots had an average yield of 18.3 bushels/acre compared to Parkland plots with an average yield of 13.9 bushels/acre.

Root Rot and Root Maggot Damage on Argentine Varieties Westar and Alto and the Polish Variety Tobin - Argentine varieties tend to be less susceptible to root rot and root maggot damage than Polish varieties. This experiment was conducted to evaluate the Argentine varieties, Westar and Alto and compare them to the Polish variety Tobin. Root rot and root maggot damage was assessed as well as emergence and yield response.

The plots were seeded on May 15 and replicated four times. Fertilizer was added according to recommendations from the soil test results. Plants were sampled by removing 10 plants at random from each plot and assessing root damage severity.

Root rot damage was severe on the Polish variety Tobin with an average of 3.1 compared to the Argentine varieties Westar and Alto with averages of 1.5 and 1.4 respectively.

Root maggot damage was lowest on Westar with an average of 0.45 compared to Tobin at 0.95 and Alto at 1.08.

Westar and Alto had significantly higher yields compared to Tobin with yields of 22.8 bushels/acre. Westar had the highest yield at 35 bushels/acre and Alto had yields of 30.6 bushels/acre.

Effects of Seeding Date on Incidence of Root Rot and Root Maggot Damage, Stand Establishment and Yields of Tobin Canola - This research compared the performance of Tobin seeded at 4 different dates on stand establishment, yield and root rot severity as well as root maggot damage. Soil temperatures were also monitored for correlations between soil temperature, emergence, yield and root rot damage.

Plots of Tobin canola were seeded at 4 different dates and replicated 4 times. Seeding dates were May 8, May 15, May 23, and May 30. Fertilizer was added according to soil test recommendations. Plants were sampled by removing 10 plants at random from each plot and assessing root damage severity.

Soil temperature readings were taken at four depths, 3 cm, 5 cm, 10 cm and 15 cm with a Fluke 51 thermometer and type K thermocouple probes. Readings were recorded about 9:00 am each morning, every week day except when the soil was too wet to walk on the surface. Readings were taken from May 9 to July 6 (Figure 8).

Stand establishment is shown in Figure 9. The highest stands were recorded from Tobin planted on May 23, the third seeding date. The lowest stands were from the plots seeded on May 8. There appears to be some correlation between soil temperature and emergence.

Figure 8: Soil temperature readings at four depths from May 9 - July 6, 1990. Farm site - Fairview

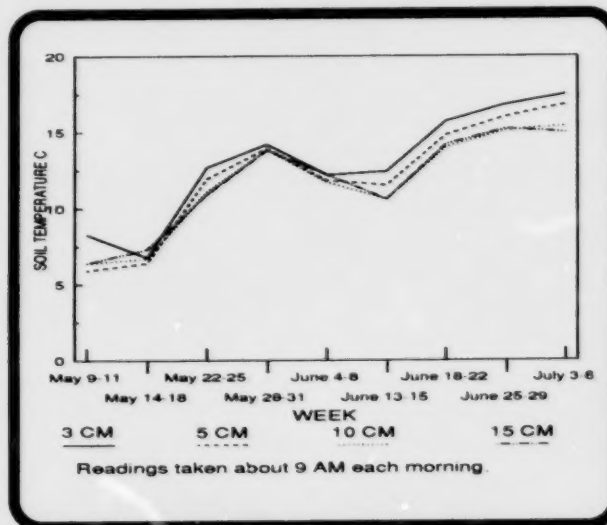
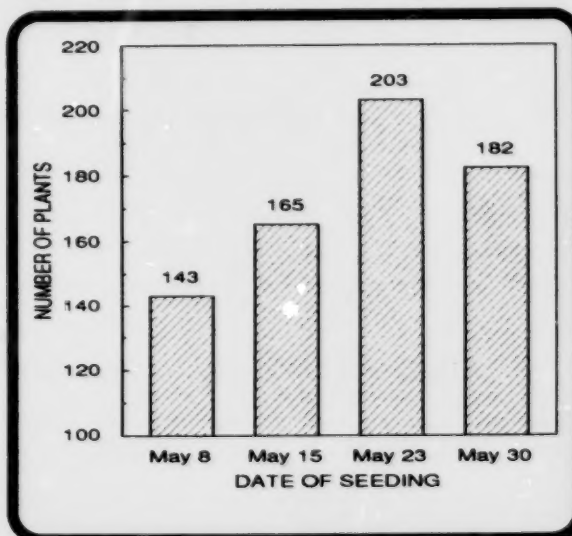


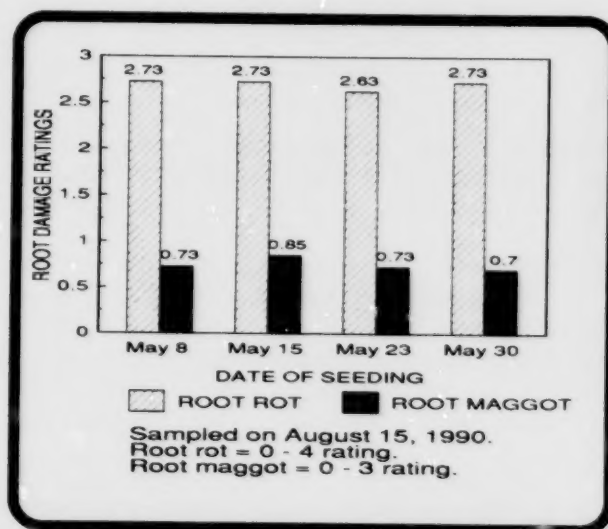
Figure 9: 1990 emergence of Tobin canola at four dates of seeding. Farm site - Fairview



Plants seeded on May 8 were emerging when the soil temperature was cool at 6.4°C and emergence was 143 plants. Emergence of plants seeded on May 15 increased to 165 plants when soil temperatures increased to 11.9°C. Plants seeded on May 23 had the highest emergence rate of 203 plants when the soil temperature was highest at 13.9°C. Plants seeded on May 30 had a lower emergence rate of 182 plants but the weather turned cooler and the soil temperature decreased to 11.8°C.

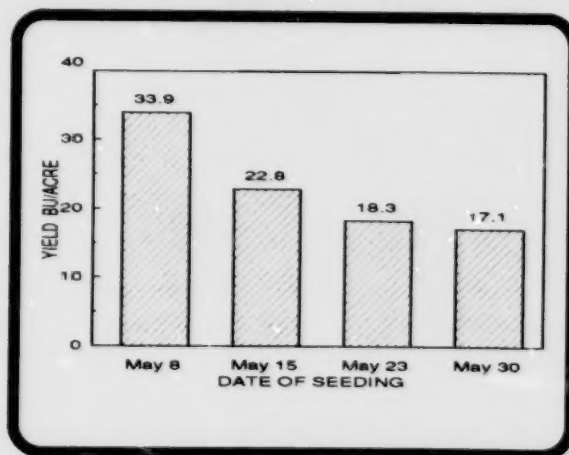
There was no correlation between soil temperature readings and root damage ratings. There was no difference in root rot severity or root maggot damage between Tobin seeded at the 4 different seeding dates. (Figure 10). Root rot damage on Tobin was greater than root maggot damage and probably accounted for a greater proportion of the yield loss. Data from the plants sampled show that 100% of the roots had some root rot damage compared to 58% of the roots that had root maggot damage.

Figure 10: 1990 root rot and root maggot damage of Tobin canola at four dates of seeding.
Farm site- Fairview



The yield results of Tobin seeded at four different dates are shown in Figure 11. These yield results are partially explained by the unusual weather experienced in 1990. Heavy rains fell in mid June. The plants seeded on May 8 were at the bolting stage and were large enough to take advantage of the extra water while the canola seeded on May 30 were at the seedling cotyledon stage and were set back from the excess water. Very little rain fell after the June storm and the soil moisture was extremely low. The later seeded canola would have received the least amount of moisture and would have suffered drought stress and consequently decreased yields.

Figure 11: 1990 yield of Tobin canola at four dates of seeding. Farm site - Fairview



Effects of Different Formulations and Rates of Potassium Chloride and Sulphur on Canola Root Rot of Tobin and Common Root Rot of Galt Barley - This experiment was conducted to determine if potassium and chloride separately or in combination would reduce root rot damage in Tobin canola and Galt barley. This experiment was coordinated with G. Coy, Soil Specialist, who added treatments of different formulations of sulphur to the experiment to determine the effects on yield response. The barley plots were seeded on May 30 and Tobin canola was seeded on May 31. The fertilizer treatments were banded prior to seeding with the six row seeder. Plants were sampled by removing 20 plants at random from each plot and assessing root rot severity.

The 16 treatments were:

- | | |
|---|---|
| 1. check | 9. NH_4NO_3 @ 44 lb./ac. |
| 2. KCl @ 20 lb./ac. | 10. $(\text{NH}_4)_2\text{SO}_4$ @ 15 lb./ac. |
| 3. KCl @ 40 lb./ac. | 11. $(\text{NH}_4)_2\text{SO}_4$ @ 30 lb./ac. |
| 4. NH_4Cl @ 14.3 lb./ac. | 12. KNO_3 @ 27 lb./ac. |
| 5. NH_4Cl @ 28.6 lb./ac. | 13. KNO_3 @ 54 lb./ac. |
| 6. K_2SO_4 @ 23.4 lb./ac. | 14. Sulchem 68 @ 30.4 lb./ac. |
| 7. K_2SO_4 @ 46.8 lb./ac. | 15. Sulchem 95 @ 17 lb./ac. |
| 8. NH_4NO_3 @ 22 lb./ac. | 16. Sulchem 68 @ 15.2 lb./ac. |

There was no significant differences in root rot damage between the fertilizer treatments on canola and barley. In 1990, there was no effect on reducing common root rot of barley when different rates and combinations of potassium, chloride and sulphur were added.

WEED CONTROL SECTION

The level of weed control in Alberta was generally good in 1990. Weather conditions during the post-emergence spraying season were conducive to good herbicide performance. In the Peace River Region and the Olds-Calgary areas of the province, heavy rainfall in the spring and early summer caused flooding, delaying planting and subsequent weed control. Poor performance from soil applied herbicides were noted in the areas of higher than normal rainfall.

a. Biological Control

Activities focused on leafy spurge, toadflax, Canada thistle, scentless chamomile, field bindweed and bladder campion. With the exception of leafy spurge, for which there were six potential agents released, all others had one candidate involving one or more sites. (Table XIV)

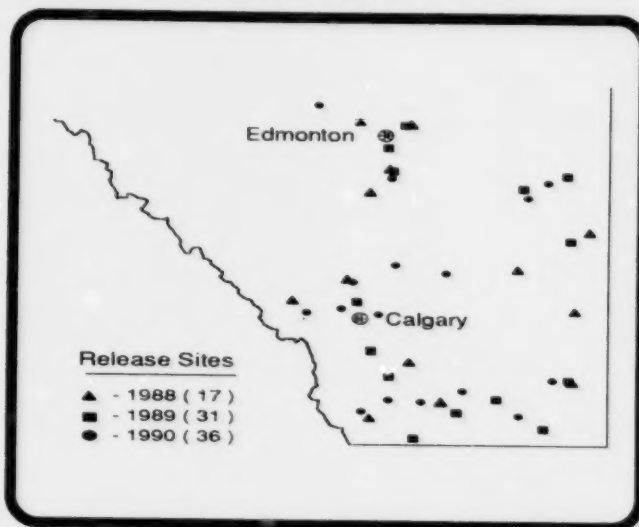
Table XIV: Agents Released for Biological Control of Weeds in Alberta, 1990

Target Weed	Agent	Type of Injury Produced	Number of Releases
Leafy spurge	<i>Aphthona nigriscutis</i>	Root Feeding Flea Beetle	48
	<i>Aphthona flava</i>	Root Feeding Flea Beetle	2
	<i>Aphthona lacertosa</i>	Root Feeding Flea Beetle	1
	<i>Pegomya euphorbiae</i>	Root Feeding Flea Beetle	1
	<i>Lobesia euphobiana</i>	Shoot Tip Tying Moth	1
	<i>Spurgia esulae</i>	Shoot Tip Gall Midge	1
Canada thistle	<i>Larinus planus</i>	Seed Feeding Weevil	1
Toadflax	<i>Calophasia lunula</i>	Defoliating Moth	13
Field bindweed	<i>Tytta luctuosa</i>	Defoliating Moth	1
Bladder Campion	<i>Cassida azurea</i>	Leaf Feeding Beetle	2

The major work has been with the black dot spurge beetle (*Aphthona nigriscutis*) which has been redistributed several times in the last few years (Figure 12). Successful establishment occurred in 69% of the cases in 1989 and 66 in 1990.

Over the last three years, both the *Aphthona nigriscutis* (black dot spurge beetle) and the *Aphthona flava* (copper spurge beetle) have distributed throughout the spurge growing area of the province (Figure 12).

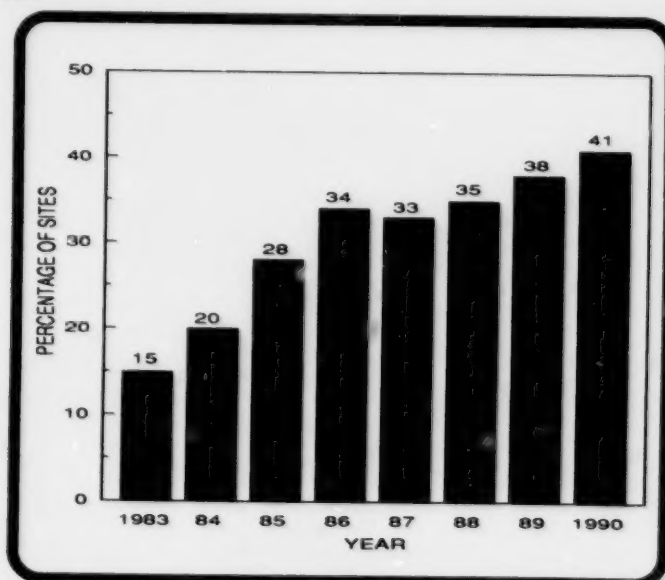
Figure 12: *A. nigriscutis* release sites on leafy spurge, 1988 - 1990



b. Restricted Weed Control Program

The search and destroy approach for diffuse and spotted knapweed continued. Infestation levels continue to decline and regrowth in the known infestations are limited to an annual dwindling seed supply. Populations have been reduced from the original 350 acres to less than 10 acres comprised of scattered patches ranging from one plant to several hundred square feet.

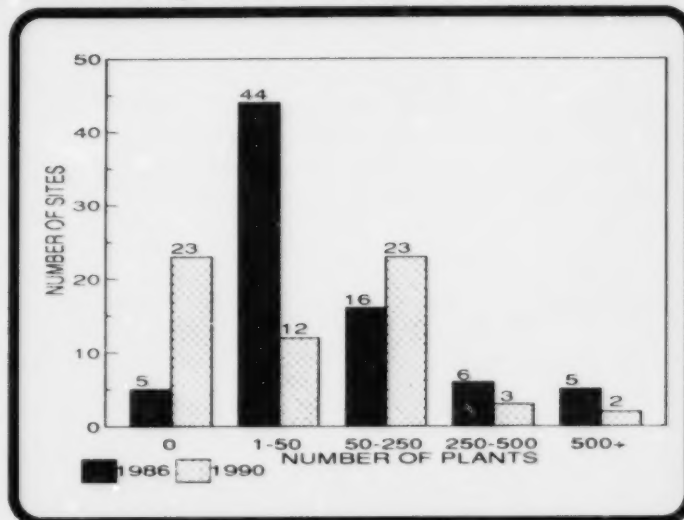
Figure 13: Degree of eradication on monitored sites originally infested with diffuse and spotted knapweed



Jasper National Park undertook a knapweed eradication program during 1991. A program strategy was developed and executed. Park crews searched, mapped and hand pulled all infestations. The Park plans to monitor and destroy new infestations to ensure eradication is achieved.

The nodding thistle eradication program progressed very well and infestation levels continue to decline (Figure 14). No new infestations were reported.

Figure 14: Populations of nodding thistle on monitored sites, 1986 and 1990



A dodder infestation was found in an alfalfa seed field in the Brooks area. Eradication measures were undertaken and monitoring will continue. To ensure eradication, methods will be evaluated with potential registration under the Minor Use Program.



c. Weed Control Act

The Weed Control Act was amended and proclaimed in the fall of 1990. The amendments included changes to the appeal process, increased fines for violation and realignment of sections to provide clearer understanding of the process. Timely enforcement and fairer treatment of the landowner were also components.

The following weeds were added:

Restricted Weeds: Dodder, yellow star thistle.

Noxious Weeds: Blueweed, spreading dogbane, field scabious, hound's-tongue, oxeye daisy, tall buttercup.

d. Minor Use Program

The Minor Use Program is designed to provide a means for the agricultural community to register needed additional pesticide uses on small acreage crops or weeds that are not widely distributed or which are not addressed by the manufacture in the normal registration process due to cost or time limitations. The Branch focus remains on forage crops and is operated in conjunction with the Alberta Forage Council and the Alberta Forage Seed Council.

The registrations obtained as a result of the program are shown in Table XV.

Table XV: Minor Use Registrations

Herbicide	Crop	Stage	Crop Use
Hoegrass II	Bromegrass	Seedling	Seed Production
	Creeping Red Fescue	Seedling	Seed Production
	Russian Wild Ryegrass	Seedling	Seed Production
	Crested Wheatgrass	Seedling	Seed Production
	Intermediate Wheatgrass	Seedling	Seed Production
Lontrel	Kentucky Bluegrass	Seedling & Established	Forage & Seed
	Bromegrass	Seedling & Established	Forage & Seed
	Reed Canary Grass	Seedling & Established	Forage & Seed
	Creeping Red Fescue	Seedling & Established	Forage & Seed
	Meadow Foxtail	Seedling & Established	Forage & Seed
	Tall Fescue	Seedling & Established	Forage & Seed
	Orchard Grass	Seedling & Established	Forage & Seed
	Alberta Wild Ryegrass	Seedling & Established	Forage & Seed
	Russian Wild Ryegrass	Seedling & Established	Forage & Seed
	Timothy	Seedling & Established	Forage & Seed
	Crested Wheatgrass	Seedling & Established	Forage & Seed
	Intermediate Wheatgrass	Seedling & Established	Forage & Seed
	Slender Weatgrass	Seedling & Established	Forage & Seed
	Streambank Wheatgrass	Seedling & Established	Forage & Seed
	Tall Wheatgrass	Seedling & Established	Forage Only

e. Crops of Alberta

Crops of Alberta, a co-operative project between the University of Alberta and Alberta Agriculture, is a display which exhibits the diversity of crops and crop varieties grown in Alberta. The 1990 theme focussed on the University of Alberta's 75th Anniversary celebrations. As a result of the theme, there was a concentration on varieties that were developed at the University.

The inclusion of historical and ancestral varieties continued and highlights of new crops such as miniature sunflowers and herbicide resistant crops were also part of the demonstration. The display was used as a teaching aid to many urban elementary school children who tour the site each fall. It also provided a laboratory for plant science classes at the University of Alberta. Overall, it provided the opportunity for many urbanites to watch the growth, development, maturity and harvest of crops, many of which they saw for the first time.

f. Weeds Resistant to Specific Herbicides

The confirmation of weeds resistant to specific herbicides will have a major impact on the producer, the agricultural chemical industry and the extension agents. They add one more dimension to the process of selecting the most appropriate method of weed control. These resistant strains do not differ visually from the susceptible ones and can only be detected through bioassay techniques.

To date, the frequency of weed resistance remains rare (Table XVI), however, the potential for expansion is quite high, particularly if producers use the same herbicide or the same class of herbicides year after year on the same field.

Table XVI: Status of Confirmed Sitings of Weeds Resistant to Specific Herbicides

Herbicide Class	Number of Sites			
	Green Foxtail	Chickweed	Kochia	Wild Oats
Dinitroanilines (Treflan, Edge, Advance, Heritage, Fortress, Rival, Triflurex)	1	-	-	-
Sulfonylureas (Glean, Ally, Refine)	-	-	8	1
Thiocarbonates (Avadex)	-	-	-	15
Unclassified (Avenge)	-	-	-	12

A further complicating feature can be cross resistance, that is the resistance of a weed to two or more herbicides which control the weed through different modes of action. To date, several wild oat strains that are resistant to both thiocarbonate (Avadex) and difenzoquat (Avenge) have been confirmed.

g. Development of Weed Control Measures

In accordance with the branches pest mitigation strategy, weed research is continuing to develop control strategies for developing weed problems.

1. The recent expansion of toadflax acreage due to an increased emphasis on reduced tillage has stimulated the development of four projects to examine methods for the in-crop suppression of this weed in cereals: the potential of alternative fall and spring treatments in a continuous cropping regime and various summerfallow treatments. The amalgamation of a composite of these treatments is intended to result in an overall system of toadflax control.
2. Two weeds which are native plants caused some problems in parts of the province this year; they were water smartweed and spreading dogbane. They have developed their weedy potential as a result of reduced tillage operations. Work on the screening of potential herbicides followed by the development of rate and timing criterion was initiated. While initial results suggest some very promising control alternatives for spreading dogbane, there are no apparent economical control measures for water smartweed. Work will continue.
3. Ox-eye daisy and common tansy are two perennial weedy species which are reducing the productivity of forage stands and pastures. While work on the development of suitable control measures was initiated several years ago, progress has been slow due to the fact that most of the legume crops are sensitive to many of the potential controls.

4. Final tests were conducted on the first biological herbicide (mycoherbicide) Biomal. Biomal which is a formulation of a native plant disease, affects only the weed round-leaved mallow. It is expected to be commercially marketed in either 1991 or 1992.
5. Work is continuing on a co-operative effort with Agriculture Canada and the Pulse Growers Commission to develop effective methods for the control of broadleaved and grassy weeds in field peas. A major component of this study is the determination of varietal tolerance and the development of the window of application.

h. Training

The Crop Protection Update continued to be offered to district agriculturists, agricultural fieldmen, specialists, and industry to convey the most current information on weeds, insects, plant diseases, and vertebrate pest management strategies. This course has been offered for over 12 years with the comparative attendance for the last five years shown in Table XVII.

Table XVII: Attendance at Crop Protection Update					
Client	1991	1990	1989	1988	1987
District Agriculturists	21	18	26	10	11
Agricultural Fieldmen	106	96	51	50	44
Company Representative/Industry	15	21	13	6	4
Other	25	34	27	16	16
Total	167	169	117	82	75

For the second year, the course was held in conjunction with the Agricultural Fieldmen's In-service Training Course, but due to logistic problems, this joint venture will be discontinued in 1992.

Four separate training sessions were provided for agricultural fieldmen and agricultural service board members to orientate them with the new Act and to provide direction on its enforcement. Approximately 100 people were trained.

Training for weed inspectors continued. Six weed inspection schools (one per region) were held with over 200 attending from both rural and urban areas. The number of urban weed inspectors attending, is increasing. Training concentrated on interpretation and effective use of the Weed Control Act, proper enforcement techniques, weed identification, blackleg identification and survey methods.

Branch staff are reducing the emphasis on resourcing local farm meetings. They are replacing this function by helping district staff acquire the expertise to handle their own meetings.

ENTOMOLOGY SECTION

This section's programs include extension, research, monitoring and detection, and support to diagnostic services. The section's purpose is to develop pest management strategies and programs to reduce losses to insect pests, improve pest-management decision making, and consequently reduce the negative impacts of pest management practices.

The most significant economic losses caused by insects resulted from feeding by bertha armyworm larvae (*Meunestra configurata*) on canola and by grasshoppers (primarily *Melanoplus spp.*) on cereal crops.

Approximately 150,000 acres of canola were sprayed to reduce bertha armyworm populations, and in excess of 100,000 acres were sprayed for grasshoppers. Army cutworm (*Euxoa auxiliaris*) infested more than 24,000 acres of crop land, primarily winter wheat, in southern Alberta.

a. Cereal Insects

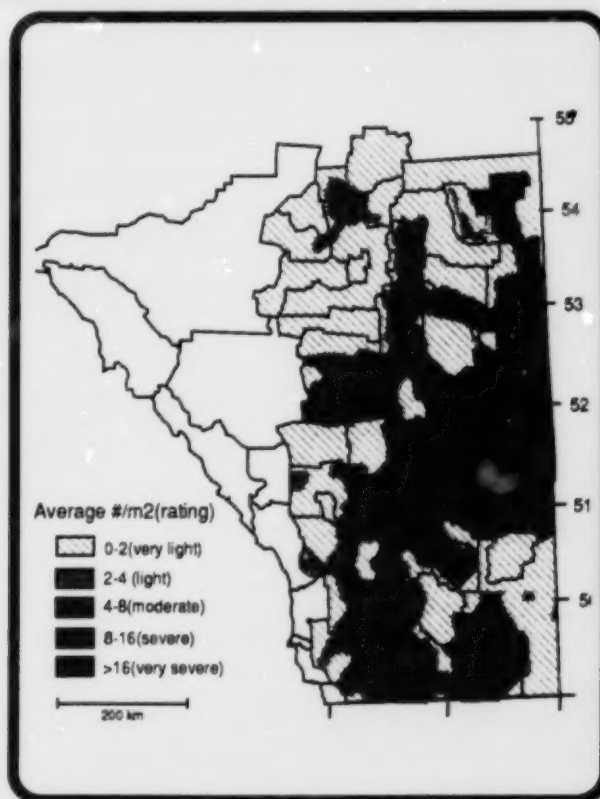
1. Grasshopper Monitoring

The overall severity and geographical distribution of grasshopper infestations in Alberta remained steady over the period 1988 - 1990. A gradual decline in prominence of this pest has not removed localized persistent problems in east-central Alberta, although the infestation in southwestern Alberta subsided in 1990.

Crop damage was reduced by insecticide spraying but infested areas continued to exhibit the high densities and active migration normally seen during outbreaks.

The forecast for 1990 (Figure 15) indicated scattered low to moderate infestations in most areas. High but localized infestations were present near Cardston (MD 6) and in Special Area 4 (MD 52 south of Provost). In 1989 it was forecast that populations in Cardston county could resurge if spring and summer weather were warm and dry. This forecast materialized: average temperatures and below-average rainfall during April - June did not reduce hatching survival and these localized infestations were maintained. Extensive rainfall during August, 1989 reduced breeding success and the infestation did not reappear in 1990. However, grasshopper densities were high in isolated areas near Lethbridge. A small infestation in County 11 (Barrhead) and County 28 (Lac Ste. Anne) were downgraded on the forecast map because above-average rainfall reduced the potential for this flare-up to expand. Grasshoppers were very abundant along the Saskatchewan border in east-central Alberta, particularly in the Oyen - Wainwright area. More than 100,000 acres were sprayed with insecticide to limit economic damage.

Figure 15: Alberta Grasshopper Forecast - 1991



Provincial government financial assistance (to a maximum of \$75,000) was available to producers in the Special Areas to offset costs of insecticide applications. Alberta Agriculture and the Special Areas each expended \$43,805 to cover 50% of the chemical costs paid by farmers.

The fungus disease *Entomophthora grylli* increased its prevalence, but only against one species of grasshopper. The special "pathotype" of this microbe that attacks the clear-winged grasshopper became common in late 1989, apparently affecting up to 30% of this species at some sites. Overall impact of this disease has probably reduced infestations by no more than 10%.

Table XVIII shows a summary of levels of infestation for the entire surveyed area of Alberta. The areas shown are calculated from the grasshopper map and include crop and rangeland. The high risk area decreased as compared to the previous two years.

**Table XVIII: Area of Risk Categories,
Based on Grasshopper Breeding
Density**

Legend	Area (%)	Area (square km)
very light	39.9	74,610
light	41.5	77,600
moderate	10.7	20,010
severe	6.1	11,410
very severe	1.8	3,370
Total	100.0	187,000

The 1990 forecast map was based on survey data reported by Agriculture Service Board fieldmen from 53 counties, municipal districts and improvement districts, based on visits to 1,680 sites. These surveys are conducted yearly in late summer/early fall. Risk analysis for grasshopper infestation is done by Agriculture Canada, Lethbridge.

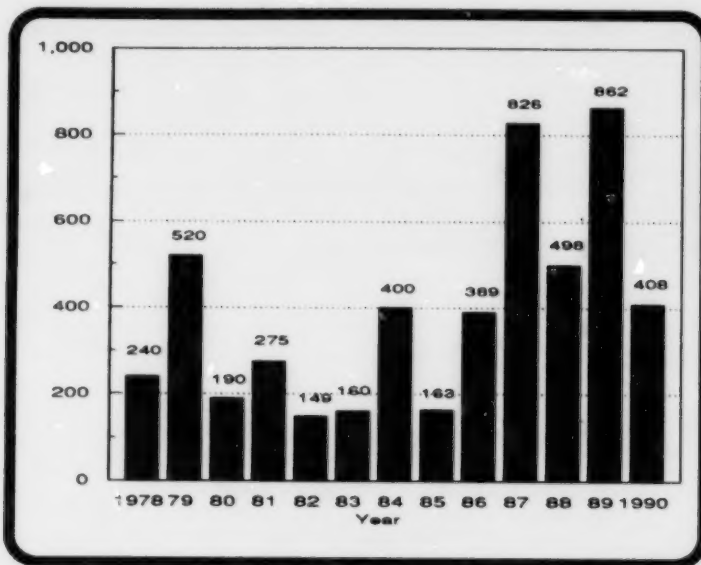
2. Cutworm and Armyworm Surveillance Monitoring

The joint Alberta Agriculture/Agriculture Canada program aimed at gathering baseline data from pheromone traps at thirteen locations throughout Regions I - V was continued for the sixth year. District agriculturists and entomologists set out the traps with pheromones chemically designed to attract the target species: army cutworm, bertha armyworm, pale western cutworm and redbacked cutworm. Pheromone monitoring was terminated in the Peace because too many bumble bees were being caught in the traps.

Army Cutworm infested over 24,000 acres of crop land in southern Alberta, particularly in the Vulcan, Lethbridge and Taber areas. About 15,000 acres were sprayed and about 10,000 acres were reseeded, with or without spraying. Army cutworms overwinter as partially grown larvae and are usually a pest of fall-seeded crops where food is available in both the fall and early spring. In 1990, however, the most severe infestations occurred in spring crops planted on summerfallow where winter annual weeds (particularly flixweed and stinkweed) were present the preceding fall. Approximately 60% of larvae were parasitized by an encyrtid wasp, *Copidosoma sp.* This high rate of parasitism apparently exacerbated crop damage. Normally the cutworms pupate by early to mid May, however, the large population of parasitized larvae persisted into June. Parasitized larvae are considerably larger when mature, eat more and remain larvae longer than healthy larvae before succumbing to the parasites. Consequently, they destroyed more crop than they would have, had they not been parasitized.

Pheromone trap catches of army cutworm moths in the fall of 1989 were higher than at any time during the twelve years of monitoring at Lethbridge (Figure 16). The high levels of parasitism in the spring and the dry weather in the fall reduced populations leading to a low risk for 1991.

Figure 16: Average number of army cutworm moths collected along highway No. 3 sampling locations during the years 1978 - 1990



Pale Western Cutworm (*Agrotis orthogonia*) and Redbacked Cutworm (*Euxoa ochrogaster*) populations remained low. No problems with these species or with Clover Cutworm (*Discestra trifolii*) were recorded in 1990 or are anticipated for 1991 (Figures 16 A, B, C).

Figure 16a: Alberta surveillance monitoring program, redbacked cutworm - 1990

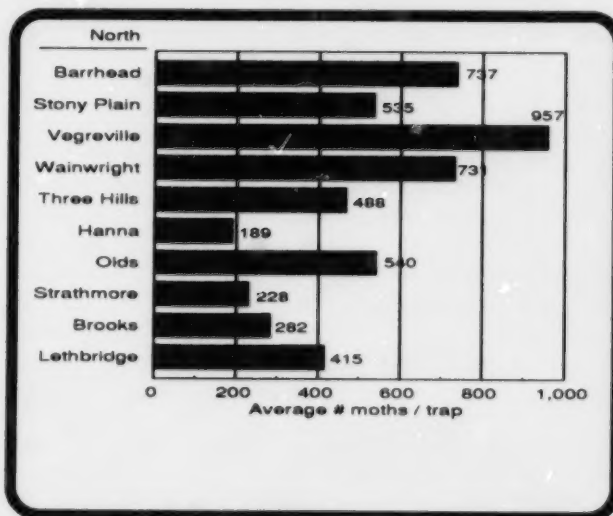


Figure 16b: Alberta surveillance monitoring program - pale western cutworm, 1990

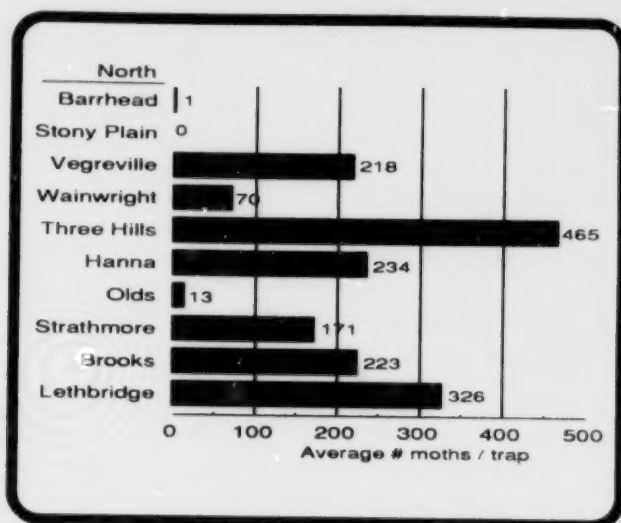
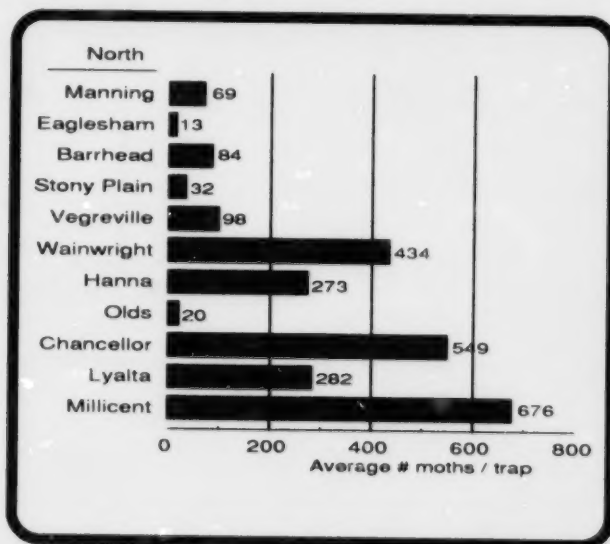


Figure 16c: Alberta surveillance monitoring program - clover cutworm, 1990



Russian Wheat Aphid (*Diuraphis noxia*) overwintered successfully in 1989/90 because the winter was milder and shorter than in 1988/89 (the first winter that the aphid infested crops in Alberta but did not survive). Adults survived temperatures of -5°C without effect on their longevity or reproductive success. Colder temperatures have been found to induce mortality; greater mortality occurs with increasing length of exposure. By the fall of 1990, the species' range in Alberta had expanded to include areas just north of Calgary.

Fields south of Lethbridge had at least 40% of plants infested. Fields seeded prior to August 30 were 100% infested. The infestation was the highest to date and significant damage to winter wheat would have occurred had the aphid overwintered.

Barley Thrips (*Limothrips denticornis*) occurred throughout the province but were most abundant in Region 3 (near Wetaskiwin) and 6 (near Fairview). Population densities of 50 adults per head were common near Wetaskiwin and estimates of economic losses in this area ranged from 5 - 18 bushels per acre.

Grain Stink Bug (*Chlorochroa uhleri*) populations were scarcely in evidence in 1990. Few stink bugs could be found even in areas infested in the fall of 1989 (Wrentham, Turin, Enchant).

European Corn Borer (*Ostrinia nubilalis*) larvae infested corn fields in the Taber area. Fields of processing corn were sampled in early September during harvest. The heaviest infestation was 16%. Very few cobs were infested and lodging was minimal.

Wheat Stem Sawfly (*Cephus cinctus*) were found infesting fields at harvest in the Bassano and Medicine Hat areas. It is believed that populations throughout southern Alberta have been increasing over the past few years and that problems may appear on a much larger scale.

b. Oilseed Insects

Bertha Armyworm infested about 370,000 acres (more than 50% of canola acreage planted in municipalities reporting infestations); approximately 150,000 acres were sprayed with insecticides (Figure 17). Pheromone trap collections of adults were extremely high (>1,000) in Vulcan and Red Deer counties. Outbreak densities did not develop in southern areas despite the high moth populations. Economic damage occurred in Regions 2 - 5 but was greatest in the counties of Three Hills, Red Deer, Olds, Smoky Lake, Vermilion River, Provost and Westlock where 84% of the total spraying occurred (Figure 18). Collections of larvae from Region 4 had moderate (ca. 30%) levels of parasitism by an ichneumonid wasp (*Banchus flavescens*) and a tachinid fly (*Athrycia cinerea*).

Figure 17: Acres sprayed for bertha armyworm in Alberta, 1971 - 1990

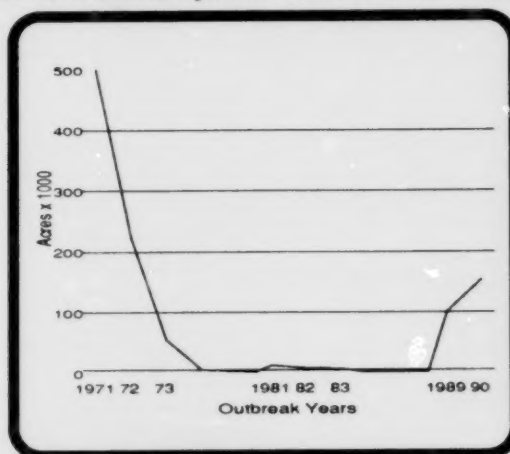
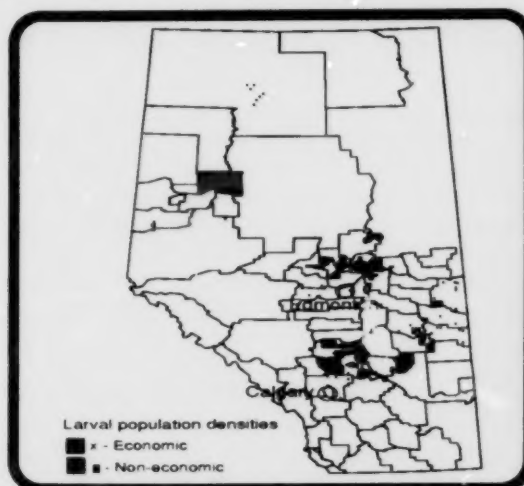
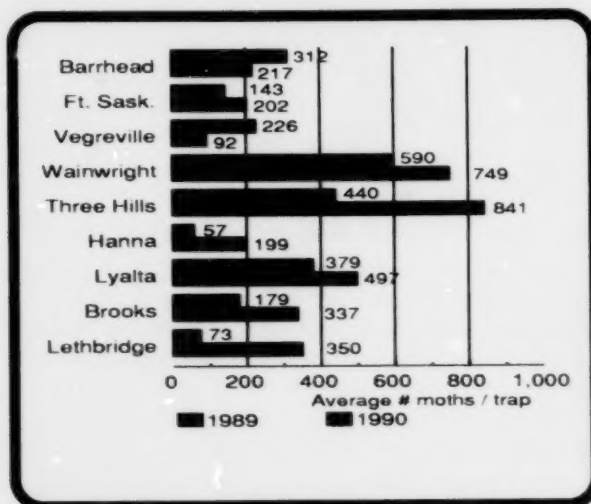


Figure 18: Distribution of bertha armyworm larval infestations in Alberta during 1990



Pheromone monitoring for bertha armyworm was expanded in 1990 to thirty-seven sites in thirty municipalities. District agriculturists and agriculture fieldmen were the primary cooperators. Traps were set out in fields at the beginning of June and moths collected every two weeks until the end of July (Figure 19). Moths were identified at Lethbridge; risk analyses and communications on the outbreak came from Brooks. The program provided several benefits: (1) timing of damage periods was predicted to be later than normal. Infestations persisted into September in the Olds - Red Deer area. (2) relative risk of larval infestation was fairly accurately predicted with the exception of Region 1 where for unknown reasons, populations did not materialize following the catches of large numbers of moths. (3) awareness in field staff and producers was increased and likely reduced the surprise element inherent in agricultural insect pest outbreaks.

Figure 19: Average numbers/trap of bertha armyworm moths collected from selected sites during 1989 and 1990



It is anticipated that populations of bertha armyworm will be high in 1991. The pheromone trapping of bertha moths will be expanded to monitor the infestation and provide farmers with pre-infestation information on management of the pest.

Root Maggots (*Delia spp.*) were widespread and particularly abundant in the higher rainfall areas of Regions 4 and 5. Yield losses were reportedly greater in Polish than Argentine canola varieties.

Flea Beetles (mainly *Phyllotreta cruciferae*) caused damage to canola seedlings in some areas of Region 4 despite the use of treated seed. Infestations were very patchily distributed and were usually associated with the lack of appropriate crop rotation. Some feeding damage by newly emerged adults occurred late in the season when the crop was in pod.

Diamondback Moth (*Plutella xylostella*) infested canola throughout the province but occurred in unusually high densities in Region 6. Most economic damage was observed in eastern Alberta, especially in the Wainwright, Vermilion and Provost areas. No crops were sprayed to control diamondback larvae.

Aphids were reported in high densities in canola, wheat and barley in most areas of the province. There were only isolated reports of spraying for aphids (e.g., 250 acres of wheat were sprayed in the Wetaskiwin area) and by late season lady beetle larvae and adults had eliminated aphid populations.

Lygus Bugs (*Lygus spp.*) were widespread in Alberta on canola but were most damaging in the Peace River Region. Damage there became evident at swathing.

c. Special Crop Insects

Seedcorn Maggot (*Delia platura*) heavily infested bean fields in the Taber area during May to mid June. Moist cool soil conditions delayed bean seedling emergence and likely predisposed plants to maggots and decay organisms. One hundred and forty acres of great northern beans were reseeded. Yield losses from the late developing reseeded acres and the remaining damaged acres were estimated at \$27,000.

d. Forage Crop Insects

Rangeland Woolly-bear Caterpillars (*Grammia blakei*) infested pastures and rangeland in southeastern Alberta. Hays, Bassano and Hilda are sites of recent recurrent infestations of this grass-feeding moth larva. A 200 acre field of crested wheat pasture was destroyed in the Hilda area; otherwise, the insect caused no economic damage.

A Weevil (*Ceutorhynchus erysimi*) was found heavily infesting swathed alfalfa in the Olds area. The population was apparently localized in a small field at levels of 5 - 10 weevils per sweep. This is the first record of this species in Alberta. Although some leaf damage was evident in the stubble foliage, feeding was not observed.

Crop Protection Research Centre

Developmental activities at the Crop Research Centre is centered on the development of interactive crop protective measures.

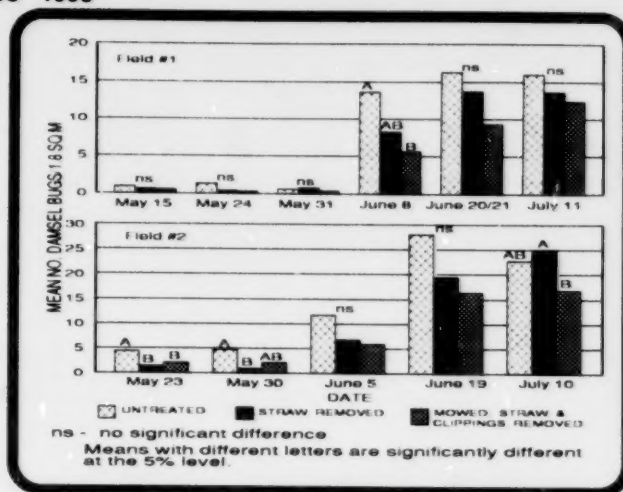
- Experiments located at Olds and Strathmore were conducted to evaluate the impact of barley leaf diseases on yield. Control of the disease with fungicide was poorer than usual due to the high disease pressure. However, the early applications of fungicides still produced yield increases of between 8 and 11 bushels per acre. A double application produced a yield of increase of about 15 bu/ac at the Olds site. However, inconsistent results were obtained at the Strathmore site where the crop was under moisture stress later in the season.
- A study evaluating leaf disease resistance in barley was conducted at Strathmore, Olds, Lacombe and Edmonton. Twenty barley cultivars were studied and detailed information was obtained regarding their level of resistance to barley scald and net blotch under field conditions. Cultivars varied in their disease susceptibility, yield response and degree of control when treated with a foliar fungicide. Several cultivars (Argyle, Galt, Samson and Bonanza) appeared unresponsive to disease control in terms of yield increases despite large reductions in disease levels. Johnston appears to provide greatest yield increases to small reductions in disease levels. All other cultivar yield responses were fairly consistent with the level of disease control achieved.
- Studies examining the interactive effects of fungicides, insecticides and plant growth regulators were continued. The insecticide DECIS was found to significantly reduce leaf disease levels in two experiments, which was similar to what happened last year. The low rate of the fungicide TILT caused increases in the levels of thrips. In previous years, when applied at a higher rate, TILT was found to decrease the number of thrips. Further work is planned to examine these results. The plant growth regulator, CERONE, provided excellent lodging control but had no effect on either disease levels or thrips numbers.
- Other studies conducted include: evaluation of the effects of plant nutrition on barley leaf disease development; evaluation of the effects of Alternaria blackspot on yield losses in canola; effects of Ascochyta blight on pea yields; disease surveying; screening of barley breeding lines for resistance to surface-borne smuts and true loose smut; and evaluation of breeding and coop lines for resistance to barley leaf diseases.

Evaluation of the effects of 1) spring straw removal and 2) mowing combined with the removal of straw and clippings, on damsel bug (*Nabis alternatus* and *Nabiacula americolimbatus*) population levels in creeping red fescue.

Damsel bugs are predators of plant bugs, leafhoppers and other insect pests found in creeping red fescue. When cultural control methods are evaluated it is important to determine their effects on beneficial insects. Two second seed year creeping red fescue fields in the fairview area had straw removed with a combination of harrows and hand rakes between May 6 and 9. Plots were mowed, harrowed and hand raked between May 9 and 12, and damsel bugs samples from mid-May through mid-July.

These cultural practices did not appear to have a major impact on the damsel bug population level (Figure 20).

Figure 20: Population level of damsel bugs in creeping red fescue under two different cultural control regimes - 1990



Early season distribution of barley thrips in litter in different grass species.

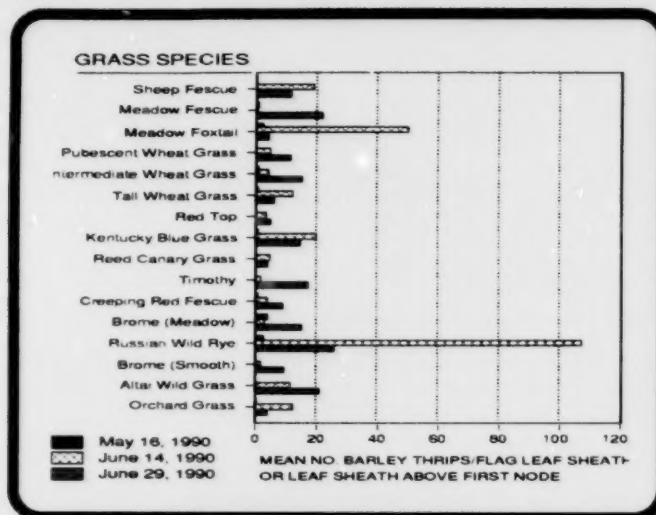
The objective of this study was to determine where the barley thrips are distributed in the early spring. Three 1/8 m² samples of grass litter from different grass species plots were collected from the Olds College forage plots and examined for thrips on May 9 and 11. The highest thrips populations were found in orchard grass, meadow fescue, smooth brome grass, sheep fescue, Kentucky blue grass and creeping red fescue (Table XIX).

Table XIX: Barley Thrips in Grass Litter on May 9 and 11, 1990

Grass Species	Mean No. Barley Thrips/1.8 square meter	Range
Tall wheat grass	0	(0)
Slender wheat grass	0	(0)
Altai wild rye grass	0	(0)
Intermediate wheat grass	0	(0-1)
Pubescent wheat grass	1	(0-3)
Crested wheat grass	1	(0-3)
Red top	1	(0-3)
Timothy	2	(1-3)
Reed canary grass	4	(2-5)
Russian wild rye grass	4	(0-11)
Meadow brome grass	7	(0-21)
Meadow foxtail	13	(8-16)
Orchard grass	21	(0-64)
Meadow fescue	39	(11-54)
Smooth brome grass	43	(4-116)
Sheep fescue	84	(93-134)
Kentucky blue grass	135	(12-337)
Creeping red fescue	278	(39-674)

Grasses in the Olds College forage plots were evaluated for thrip population levels during the summer of 1990 (Figure 21). Meadow foxtail and Russian wild rye had high population levels (over 45 thrips/leaf sheath above the first node). Sheep fescue, meadow fescue, Kentucky blue grass, timothy, meadow brome grass, and Altai wild rye grass had over 15 thrips per leaf sheath above the first node during at least one of the sampling dates. Since barley thrips move to cereals from early season grasses, the role of grasses in thrips biology is important in developing a thrips pest management program.

Figure 21: Barley thrip population levels in different non-cereal grass hosts



FIELD CROPS BRANCH

SUMMARY

The Field Crops Branch has three operational sections: Crop Production, Crop Research, and Administration. Full-time staff consists of 18 permanent positions and 8 temporary salaried positions.

The Branch is involved in province-wide crop extension and research relating to cereals, oilseeds, special crops, forages and seed technology.

The Crop Research Section's mandate is to develop improved varieties of feed grains with emphasis on feed barley. Programs are also conducted in spring and winter triticale and winter wheat for central and northern regions of Alberta.

Co-operative research is conducted with the University of Alberta, Agriculture Canada and the Agriculture Environmental Centre, Vegreville, to evaluate varieties of oilseeds and cereals adaptable to Alberta.

The Crop Production Section provided extension programs through department staff, private industry, producer groups and directly to producers.

The Municipal Co-operative Seed Cleaning Plant Program for replacing and upgrading 79 plants is co-ordinated through the Crop Production Section of the Field Crops Branch.

BRANCH ACTIVITIES

Crop Production Section

a. Cereal Crops

The publication "Varieties of Cereal and Oilseed Crops for Alberta" was revised, updated, and distributed through the "Farm Light and Power" February issue, and Agdex 100/32 at district offices. The information presented in this publication is based upon our extensive regional variety testing program to aid farmers in selecting the most suitable varieties for their areas.

During this past year requests for speaking engagements totalled 15, radio and T. V. programs - 20, with numerous news releases, letters, and phone calls on a variety of cereal crop production topics.

The major extension demands this year were in barley (particularly hulless), hard red spring wheat, oat and semi-dwarf wheat and semi-dwarf barley production. Interest remains high in minimizing cash inputs, but still receive the greatest economic return possible.

The branch initiated a province wide barley canola survey to learn the production techniques being employed by Alberta farmers and which ones are more successful in terms of increased yields. This major undertaking will involve over one thousand farmers, Field Services Division, the Statistics Branch and the Field Crops Branch. The survey will likely take over two years to complete.

One staff member was asked to join an international delegation of professionals, at the request of the Bylorussian government, to travel to Russia to analyze and recommend farming practices, which would help overcome the results of the Chernobyl disaster.

Seventy-eight municipal co-operative seed cleaning plants processed 29 million bushels of cereal grain and oilseeds for the year ending June 30, 1990. This was down 5 million bushels from last year's record high of 34 million bushels, but about 1.0 million below the previous five year average.

Table XX shows the amount of seed processed in 1990.

Table XX: General Summary (Bushels)	
	1989 - 1990
Total cleaned for Commercial Seed	23,851,032
Total cleaned for Pedigreed Seed	2,239,245
Total cleaned for Seed	26,090,277
Total cleaned for Dockage Removal	2,652,493
TOTAL PROCESSED	28,742,770
Average grain processed per plant - 1990	384,000
Previous five-year average grain processed per plant	387,000

Twenty-five seed plant upgrading grant applications were processed for a total of \$310,080. This compares to 36 applications totalling \$419,393 from last year. The 310,080 dollars paid out translates into 1.03 million dollars worth of upgrading expenditure by the 25 plants in Alberta at our 30% cost share level.

Boyle Co-op Seed Cleaning plant received their provincial grant for reconstruction in 1991-92 for \$354,091.89. Boyle actually built their plant one year earlier (with ministerial approval) on borrowed money with a provincial grant of \$400,000. Plants planning on replacement are: Queenstown in 1992-93, Radway in 1993-94, Coronation in 1994-95, Mundare in 1995-96, and Barrhead in 1997-98. Our provincial replacement program provides technical and financial assistance to these plants, each of which will cost about 1.2 to 1.3 million dollars.

b. Oilseed Crops

Principle activities were directed toward oilseeds technology transfer, utilizing on-farm demonstrations, media releases, in-service agronomic training seminars and individual contacts. Over 49 meetings were held and field tours were attended by 2,430 growers and industry representatives. Numerous articles and materials were prepared and assembled for regional and district staff, educational institutes and commodity groups. Growers and industry were very supportive of these activities.

Close liaison was maintained with oilseed organizations, crushers and exporters to facilitate communications within the oilseed complex and provide resource information. Two Alberta canola industry meetings were held to discuss the common concerns of the canola industry with researchers, crushers, producers, seed growers, grain handlers, and government. Input, direction and assistance was provided to various applied research associations and crop production organizations throughout the province.

Liaison was maintained with Agriculture Canada regarding the Canada/Alberta canola breeding project at Beaverlodge, Lethbridge and Saskatoon, as well as other Farming For the Future, federal and university oilseed research projects. Direction and assistance was provided to numerous private industry canola research programs. Canola breeding programs, both private and public, have successfully registered 10 new varieties in the past two years. Several of these varieties will be advantageous to Alberta producers through improved quality, disease tolerance and/or increased yields. University of Alberta research on cabbage root maggots has indicated significant yield reductions from this pest in Brassica campestris varieties and lesser, but still significant losses in B. napus varieties. This continuing research on control practices could have a positive impact on yields in areas infested. Two field evaluation trials on chemical control of Alternaria were conducted, however results were inconclusive due to low infection levels. Input and assistance was provided to Agriculture Canada research on canola seedling vigor research to determine those production factors which improve certified seed viability and vigor.

Participation in the Flax Council Research and Technical Committee, the Canola Council of Canada Crop Production Committee, the Alberta Canola Producers Commission Research Committee, the Western Canada Canola Rapeseed Recommending Committee, the Canola Council of Canada Research Priorities Committee, the Alberta Cereal and Oilseeds Advisory Committee and the Expert Committee on Grains Production, provided direction to oilseed research projects relevant to Alberta growers' needs and concerns. Development of a co-ordinated concept for an enhanced co-operative applied research approach among commodity groups and applied research associations resulted in the formation of a steering committee to investigate and develop a beneficial system to achieve more efficient and effective applied research. Input and direction was provided to the Canola Council of Canada/Alberta Canola Producers Commission Canola Productivity Centers program which provides growers with timely and useful production technology via on-farm demonstration, field tours, and production seminars.

A paper was presented on canola production systems in Western Canada at the International Canola Conference in Atlanta, Georgia. Phil Thomas participated as a member of the GCIRC planning committee for the 1991 International Rapeseed Congress in Saskatoon. A questionnaire was prepared for a 1991 provincial barley/canola production practices survey.

c. Perennial Forage Crops

The 10 local forage associations remained active and were supported with provincial operating grants totalling \$310,950; similar to 1989. In addition, the associations made frequent use of C.A.S.C.I. and F.F.F. on-farm demonstration funds. Forage association activities continued to include seminars, tours, forage newspapers, demonstration projects and field scale production systems.

The Alberta Forage Council (A.F.C.) continued to expand its functions. Activities included organizing the Canadian Forage Council Conference and annual meeting held in Edmonton, identification of forage industry needs, minor use of pesticide program and input into departmental planning meetings. The Alberta Forage Council formed the Alberta Forage Variety Committee (A.F.V.C.) as a sub-committee to maintain forage testing guidelines and to make recommendations on variety registration and use. The A.F.C. and A.F.V.C. work closely with the Plant Industry Division.

Public interest in forages continued to expand. Popular extension topics included intensive pasture management, fertilization, forage species and varieties and hay marketing.

Forage crops got off to a slow start in the spring of 1990 due to unseasonably cool weather. Areas with deficiencies in hay and pasture production due to drought included Oyen, Hanna, Coronation, and to some extent in Medicine Hat. Some deficiencies were also reported in the northern parts of the Vermilion region and other small areas in north central and northern Alberta. Livestock water supplies were inadequate in some parts of eastern Alberta. Surplus moisture was a problem affecting forage production in west central Alberta, especially in the west part of the Leduc and Wetaskiwin districts.

Tame hay acreage in Alberta expanded slightly to 4.65 million acres from 4.60 million in 1989 and 4.65 million in 1988. Hay production expanded to the most ever at 10.5 million tons. This compared to 9.8 million tons in 1989 and 10.0 million tons in 1988. Alberta hay production in 1990, represented 29% of total Canadian hay.

Alfalfa pellet production for the 1990-91 processing year dropped to 237,000 tonnes compared to 274,000 tonnes for the previous year. Cube production continued to expand to about 200,000 tonnes compared to 169,000 tonnes in the previous season. The shift from pellets to cubes therefore continued. Of major concern to the industry was the decline in exports of cubes to Japan, which dropped off markedly in the later part of the processing year. Exports of densified hay for 1990 expanded slightly to about 11,000 tonnes from 10,000 tonnes the previous year.

d. Annual Forage Crops

Annual forage crops continued to add stability and flexibility to the livestock industry. Their use adds a stable forage supply to supplement perennial forages as well as provide producers with the flexibility they desire when making decisions.

Cereals account for the highest acreage of silage crops, over annual crops such as corn. Barley is the preferred silage crop for feedlots and dairies which require high TDN's, whereas oats or oat-barley mixes are preferred by cow-calf producers to maintain their beef herds. Corn silage may be the most desired, but high input costs have reduced acreages to areas where they can only achieve very high yields to overcome their costs.

Field peas are attracting interest as a protein silage crop, even though there are many questions yet to be answered concerning varieties and times of cut. Field Crops will be conducting research trials in 1991 to obtain results to answer some of these questions.

Winter cereals are generally the crops of choice for annual pasture use. Fall rye is the preferred crop because of its availability of seed, ability to produce fall growth, and ability to overwinter throughout the whole province.

The use of winter and spring cereals in an intercrop system is fast becoming commonplace as producers desire the ability to silage a higher quality forage as well as graze the winter cereal regrowth in the fall. In 1990 five-hundred irrigated acres of winter cereal was intercropped with a spring cereal by one feedlot alone in southern Alberta. In Region I producers are finding that annual ryegrasses are effective in an intercrop situation.

Field Crops Branch supplied district agriculturists in central Alberta with winter triticale seed to carry out intercropping trials in their districts. These trials would not have been carried out without this coordination due to the poor availability of the winter triticale seed. If this new demand continues it may increase the winter triticale acreage in the province.

New crops such as the unlicensed oat variety "Magnum" are being tried and monitored to determine the potential as a silage in Alberta. To date, the results do not look as promising as the claims indicated.

Nineteen-ninety marked the beginning of the forage variety trials. The first plantings were carried out at the following sites:

- Irrigation - Brooks and Bow Island
- Area 1 - Bow Island and Oyen
- Area 2 - Standard and Provost
- Area 3 - Olds and Vegreville
- Area 4 - Lac La Biche and Westlock

The co-operators, in carrying out these sites, are the Alberta Special Crops and Horticulture Research Centre, Crop Protection Branch, Alberta Environmental Centre and the Chinook Applied Research Association.

Plot establishment was excellent in most areas, although moisture, either too much or too little, caused problems at Provost, Oyen, Standard and Olds. Reseeding will be carried out along with the new varieties scheduled for seeding in 1991. Producers with knowledge of these trials are very interested in seeing them and the results.

The Alberta Forage Variety Committee was set up in 1990 to carry out the "recommendation of varieties" duties of the Alberta Forage Advisory Committee. The Alberta Forage Variety Committee reports to the Alberta Forage Council who will act as the industry liaison with Alberta Agriculture and Agriculture Canada.

c. Range Management

One fact sheet was prepared, titled "Poisonous Plants on Range and Pasture", Agdex 130/666-1, revised January, 1991. A revision was necessary due to some recent research findings from Kamloops.

The recovery of native range was evident this year in some areas of eastern Alberta. Since Alberta has been subject to drought in the past few years, Public Lands and the Special Areas have offered rental reductions to reduce the stocking level on grazing leases. For several years now ranchers have been reducing stocking rates and have sold livestock because of the drought in Alberta. A good range seed set was observed from Cardston to Castor in the summer of 1990.

Special Areas is administered by Municipal Affairs who have hired a range specialist to help in managing their 3,000,000 acres of grazing leases. Field Crops has helped the Special Areas develop a range management program for that area. To date this has developed a land stewardship program, and educational program on the merits of good land range condition, and a self-help program on brush invasion.

f. Special Crops

During 1990, pulse crop varietal research was initiated and conducted at two plot sites in central Alberta. Included at these sites were the new Foreign Field Pea Screening Trial and the Foreign Fababean Introductory Trial. As well, the branch continued to contribute input and guidance into the Alberta Pulse Growers Commission demonstration and applied research plots in central and north central Alberta. The branch also assisted with four regional soil and water conservation programs under the terms of reference for CASCI. Interest in fababean production continued to increase resulting in an insect research project for this crop in cooperation with the Crop Protection Branch to investigate Lygus Bug damage and control in fababean.



Markets strengthened for most special crops during the year and more individuals and small grain companies established themselves as buyers and traders of various crops. The upside returns for special crops, either in the human edible or livestock feed categories, tended to stimulate small but encouraging acreage increases for the more traditional special crops.

Crop diversification continues to pay large dividends to those producers who produce and market special crops. The cash crop aspect has relieved large financial pressures during these recessionary times. Soil and water conservation and production sustainability is also producing monetary and non-monetary rewards as producers learn the new special crop managerial skills for each crop. Increased acres of special crops have also stimulated an increase in pedigreed seed production and processing. Many grower processors are generating extra income because of this new business.

g. Seed Technology

Interest in the area of seed technology continued to remain strong. The branch experienced increased contact from within the industry for information. As the number of private cultivars continue to increase, we can anticipate a further strengthening of the industry.

The Alberta Forage Seed Council entered into a new two year mandate with an emphasis on initiating a Forage Seed Commission. A large portion of the Council's time has been devoted to developing the proposed Draft Business Plan's Marketing Plan and Marketing Regulations. Council has responded well to the challenges they have been confronted in developing such a diverse plan for a very complex industry.

The Canadian Alfalfa Seed Council experienced a satisfying year. Council was involved in the minor use registration for Velpar. Howard Smith of Manitoba is the new President of the Council. Since his tenure in January, Council has hired a new executive manager as well as a new coordinator for the Canadian Cocoon Testing Centre. The Cocoon Testing Centre handled over 500 samples this year.

The Alberta Alfalfa Seed Producers Association continued to work effectively under the new format. The Association's Activities included minor use registration, continued research on industry concerns, as well as working towards the establishment of a Forage Seed Commission. The Association was represented at the various international and national seed schools as well as the local information and marketing seminars. The two branches were busy carrying out Farming for the Future projects, seminars, field days as well as involvement with the various Association and Canadian Alfalfa Seed Council activities.

The Canadian Forage Seed Project continued good interest despite the depressed marketplace. inventories are beginning to strengthen for most species, and the branch handled requests for approximately 11,000 kg of seed.

The Alberta Branch of the Canadian Seed Growers' Association continued to experience growth. Membership increased to 1,105 and the inspected acreage to 263,824 acres which is an all-time high. The Alberta Branch was very active in representing the growers concerns on pertinent issues. As private companies continue to expand the number of varieties they are handling, new challenges and opportunities present themselves to the membership. The Seed Guide which is distributed through Farm Light and Power continued to be popular. Producers are indicating the value of such a production.

SeCan still remains a major player in the industry. Alberta had 563 members of the 2,336 total membership. SeCan currently is handling 241 varieties of which 67 are being actively promoted. Sixty-eight per cent of the inspected acres were SeCan varieties. Membership sales for 1990 reached \$70,000,000. The royalties which were distributed back to the breeding institution amounted to \$458,729. Alberta Agriculture received \$11,000 in royalties from these varieties.

The branch continued a good working relationship with Agriculture Canada, participated and/or cooperated in the various revisions to the Seeds Act and Regulations, Authorized Establishments, as well as various training sessions and seminars.

The Seed and Grain Technology Advisory Committee continued to work towards the establishment and development of a diploma program for seed and grain technology. Unable to generate funding from Advanced Education, private industry was approached to provide support for the program. Olds College was successful in receiving this support. As a result, Olds College was granted permission to implement the seed and grain technology diploma program on a two year trial basis. This program should be a real plus for the industry as it is the first of its kind.

The four provincial seed shows: Ag-Expo in Lethbridge, Calgary Seed Fair and Hay Show, Peace Classic in Grande Prairie, and Northlands Pedigreed Seed Show all experienced an increase in exhibits for 1990. Out of province support for these seed shows remains strong. Alberta producers continued their winning ways at both the Toronto Royal and Agribition in Regina.

Crop Research Section

The 1990 research year got off to a slow start with generally cool spring temperatures that delayed germination and early plant development. Many places in central Alberta were blessed with more than adequate precipitation which caused some flooding of the research plots. This was followed by one of the driest harvest seasons ever experienced. The dry fall meant that we had difficulty obtaining stands of our winter cereals even though they were planted by the end of the first week of September. We feel that this delayed germination led to the extreme winter kill experienced at Stettler, Trochu and Olds. In Lacombe we were able to irrigate in order to assist with germination and stand establishment.

The number of registered varieties developed by the program is now five barleys, one spring triticale and one winter triticale. There is a great deal of interest being generated by Condor hulless barley and Pika winter triticale. If properly handled in the market development area these varieties could have a significant impact upon the cereal production in Alberta. In addition there is a renewed interest in Wapiti spring triticale for silage production but there is an insufficient supply of seed to meet the demand.

The Research section was reviewed for its scientific capability and achievement during August, 1990. Dr. R. Allan, a wheat geneticist with U.S.D.A., and Dr. R. Metcalfe, a barley breeder with Agriculture Canada, spent three days reviewing the research projects and facilities. Like the review in 1985 the major deficiency found in the program was the lack of adequate growth facilities to improve both the efficiency and productivity of the breeding projects. A copy of the research review can be seen in the full Field Crop Annual Report, Alberta Agriculture, Crop Research.

a. Spring Barley Program

As the barley industry as a whole moves more toward the preference for two-row types. The major impediment to progress in this area has been the development of disease resistance. The use of a field inoculation procedure to screen for field type resistance to the leaf diseases and for common root rot resistance is beginning to show positive results, but progress is slow. The development of suitable growth facilities is the only way we will be able to overcome this problem. We have had two scald resistant two-row lines in the cooperative tests but they were

judged unsuitable seed types. We are concentrating on making new crosses of adapted lines to the best disease resistant material in our germplasm. Thirty-six crosses were made in 1990 for the expressed purpose of increased disease resistance.

The semi-dwarf breeding project is very promising. In the 1990 Semi-dwarf Cooperative Test, all four of our entries outyielded both Samson and Duke checks by 2 to 11%. Two of these had resistant and moderate resistant reactions to barley scald, and all were better than Samson.

The hulless barley project is beginning to attract a great deal of attention by producers, industry and animal nutritionists. This interest is primarily due to Condor barley. Results from the Canadian Grain Commission have shown that Condor barley is averaging 25 to 30% higher lysine content over regular barley. With energy levels equal to wheat and better protein quality, Condor barley can be priced in a hog ration at a significant premium over regular barley. What we need now is to develop a separate grade for hulless barley so that it can be separated in the marketing system and priced accordingly.

b. Spring Triticale Program

As indicated in previous reports, the spring triticale program is now concentrating on the production of awnless types. In this regard over 90% of the selections from the 1990 early generation trials were awnless or awnletted. Many of these selections have Wapiti as a parent for high yielding forage production.

Except for the sprouting resistance composite, no crosses were produced in 1990. The reason is to insure that material in the program was properly evaluated to determine if the move from an awned crop type to an awnless type is in fact the correct move. Based on evaluation of lines in the preliminary yield trials and the head to row nurseries, it is apparent that a wide range of yield, seed and agronomic types were available in the awnless selections. In 1991 it will be possible to determine if improved levels of sprouting resistance were inherited from RL4137, the wheat used as the source of the awnless characteristic.

In 1990 the degree of joint advanced line testing with Agriculture Canada at Swift Current, Saskatchewan, prior to the cooperative registration trials, was increased. As a result a minimum of 4 Saskatchewan dryland sites have been added to our advanced yield trial evaluations. This will greatly assist in the evaluation of material for drought tolerance.

The study on the selection for sprouting resistance in triticale neared completion in 1990. Lines selected from populations in 1989 were re-evaluated in 1990 and demonstrated that improvements in the levels of sprouting resistance in agronomically improved plant types was possible. These same lines will be re-evaluated in 1991 for a final confirmation.

The dry growing conditions in the brown soil zone for the past several years has increased the interest in spring triticale due to its high levels of drought tolerance. Unfortunately much of the 1989 production was sold outside the province resulting in very low levels of seed supply in 1990.

The involvement in a joint Alberta-Hokkaido-Heilongjiang wheat improvement program resulted in a tour of the three sister provinces during July and early August of 1990. During the tour of Heilongjiang a day was spent reviewing the triticale program of Professor Wu at the N.E. Agriculture College near Harbin, Heilongjiang. As a result lines from our program have been sent to China for testing. In return Professor Wu will be sending triticales from their program which involves wheats derived from wheat x wild species hybridization. This should assist in expanding our triticale as well as wheat germplasm base.

A limited amount of time was once again spent on developing a viable spring wheat germplasm improvement project. Crosses involving early maturing and disease resistant conventional and introduced material were made in 1990. Of special interest were a set of materials involving Roblin and Chinese introductions with improved tan spot resistance. The improved parental lines will be of value in the triticale germplasm diversification as well as for a basis of a spring wheat breeding program in the future.

c. Winter Cereal Program

The primary emphasis of the winter cereal program has been the development of short statured winter hardy wheats and triticales for the non-traditional winter cereal production areas of Alberta. In 1990 the standard height winter triticale variety 'Pika' received registration. This is the first cultivar released from this program and shows good winter survival, snowmold resistance superior to current wheat and rye varieties as well as excellent spring

seeded forage production potential under a number of cropping systems. A joint study with Agriculture Canada on the forage potential of spring seeded winter cereals is currently in the process of publication.

High rainfall in the early part of July and the subsequent lodging aptly demonstrated the need for medium to short statured types. Quality tests carried out at the University of Manitoba indicated that wheat lines in the program have milling quality similar to the current standard Norstar and improved sprouting resistance. In 1991 a seed increase of white winter wheats will be carried out for testing at the Canadian Grain Commission. Emphasis will need to be placed on milling quality and a range of disease resistances.

A major problem in the winter cereal program is the lack of growth facilities that will allow for the implementation of rapid generation advance. At the current time without facilities it is only possible to grow one generation per year, which amounts to one third of the rate possible for conventional breeding procedures in the spring program.

d. Agronomy/Physiology

The objective of the agronomy program is to look at management practices that can be recommended to the producers in order to improve yield and crop quality. In the silage projects we are working with both winter and spring types of triticales and spring barleys to find the best mixtures for silage production to maximize yield and feed value. We are also working on cultural practices such as early swathing of triticale, seeding rates, and seeding dates of both triticales and barleys.

The objective of the physiology program is to look for traits and techniques that can be used as selection criteria and tools in the breeding programs. By assessing effects of drought over the growing season it is hoped that we will be able to determine the period when drought is most critical to yield and assess characteristics that may make some cultivars more tolerant than others. As well we are using the chemical desiccant sodium chlorate to determine if desiccation can be used in spring barleys and triticales as a means to determine phenotypic differences in tolerance that could be related to drought tolerance.

Long term research is an integral part of our research efforts with a long-term rotation being initiated in 1988. In 1990, the first 18 rotations were in their third year of production while a further 11 were in their second year of production. Heavy rains early in the season did cause some damage to the rotations but data was collected from the majority. These rotations offer a large scale testing of production practices and cultivars in cropping systems.

Last year we found that malting barley following winter rye did not perform as well as when it followed canola. Samson performed very well with a grain yield of 6.6 t/ha when sown on a green manure plow-down (peas), 1.2 t/ha more than when sown in plots previously sown to canola. As well winter triticale intercropped with barley the previous year did not suffer as much barley yellow dwarf (BYD) as did the winter wheat.

Work continued in 1990 on intensive crop management systems with projects in cooperation with Doug Penney of the Soils Branch and Dr. Lu Piening of Agriculture Canada.



SOILS BRANCH

SUMMARY

The Soils Branch consists of three sections; Soil Agronomy, Soil Improvement and the Soil and Animal Nutrition Laboratory. Research programs consisting of approximately 200 experiments are managed to develop cropping systems information that optimize production without degrading soil and water resources. Research is coordinated with numerous branches of Alberta Agriculture, the University of Alberta, Agriculture Canada research stations at Lacombe and Lethbridge and farm organizations to establish multi-disciplinary projects. Research results are distributed to farmers, other researchers, and extension personnel through extension meetings, preparation of factsheets, reports, videos and poster papers.

A soil testing and diagnostic service is provided to farmers, extension staff and other agencies and departments of government. Research into soil testing methodology is incorporated into routine laboratory operations and is transferred to the private sector laboratories.

Branch re-organization allowed for the transfer of Len Kryzanowski, Crop Nutrition Agronomist from the Soil and Animal Nutrition Laboratory to the Soil Agronomy Section.

Adolph Goettel retired after 35 years of service to the department and David Kirchmier joined our branch at the Soil and Animal Nutrition Laboratory.

Branch Activities

1. Administration Section

a. Agricultural Lime Freight Assistance (ALFA) Program

In 1981, the ALFA program was introduced to assist in the transportation costs of agricultural lime and marl. The program made liming materials available to farmers at approximately the same cost regardless of distance from the source. Liming activity peaked in 1983/84 when assistance was provided for over 21,000 tonnes of lime and marl. Reduction in net farm income has resulted in decreased liming activity with only 2,749 tonnes of lime and marl being transported in the fiscal year. Total assistance amounted to \$72,247 for an average grant per tonne of \$26.28. The program was discontinued on March 31, 1991. A summary of the program is shown in Table XXI.

Table XXI

	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89	1989/90	1990/91
No. of applicants	62	96	149	81	87	69	39	31	28	20
Total grant (\$)	150,994	349,363	645,359	302,743	335,039	315,164	110,017	128,058	99,131	72,247
No. of tonnes	4,514	11,289	21,487	11,493	12,275	11,606	4,624	5,216	3,928	2,749
Average grant per tonne (\$)	33	31	30	26	27	27	24	25	25	26
Average grant per applicant (\$)	2,435	3,797	4,331	3,738	3,851	4,568	2,821	4,131	3,540	3,612

b. Alberta Farm Fertilizer Price Protection Plan

This program was introduced in 1985 to provide grants to farmers using fertilizer for crop production on land farmed in Alberta. Assistance is provided on the basis of \$50 per tonne of nitrogen and \$25 per tonne of phosphate. A summary of the program since its inception is provided in Table XXII. This program was administered by Central Program Support.

Table XXII: Alberta Farm Fertilizer Price Protection Plan - Summary

Year	Grant Assistance \$	Fertilizer Purchases	Applications Paid	Average Payment \$
1985-86	\$21,231,853	942,865	31,161	677
1986-87	17,601,088	788,495	28,385	620
1987-88	17,415,088	791,415	27,473	634
1988-89	18,867,499	871,744	29,998	629
1989-90	18,116,022	824,976	28,634	633
1990-91	18,781,831	861,372	30,199	622
Total/Ave	112,013,465	5,080,867	175,850	636

c. Fertilizer Sales and Price Trends

Continued concern with low crop prices and rising input costs has resulted in only a moderate increase in fertilizer use and continued emphasis on efficiency. Fertilizer sales in Alberta increased to 987,100 tonnes in 1989-90 from 945,220 tonnes in 1988-89 (Table XXIII). This is the first year they have exceeded the peak of 968,442 tonnes in 1984-85.

Table XXIII: Fertilizer Sales in Alberta (1) (By Analysis and Nutrient Content)
July 1 - June 30 (Metric tonnes)

Fertilizer	1986-87	1987-88	1988-89	1989-90	1990-91
82-00 (Anhy. Amm.)	131,260	152,684	163,158	165,673	162,631
46-0-0 (Urea)	222,206	237,587	285,373	289,351	267,817
34-0-0 (Amm. NO ₃)	66,442	73,371	76,287	61,819	53,043
21-0-0 (Amm. SO ₄)	22,883	42,661*	56,697*	62,786*	58,402
28-0-0 (N. Soln.)	46,279	42,137	30,728	41,379	41,444
Other N	20,823	9,884	2,885	---	---
MAP (11/12-51/52/55-0)	244,822	249,260	284,348	286,174	257,749
18-46-0	67	---	---	---	---
16-20-0	21,292	16,386**	7,512**	---	---
Other phos.	22,390	21,334	6,826	---	---
10-34-0 (Soln.)	---	---	---	---	---
0-0-60	35,140	39,259	38,004	54,171	53,565
All others	2,251	2,235	2,953	25,628	50,403
Elemental S	---	---	---	---	---
Micronutrients	38	36	160	119	435
TOTAL	835,893	886,834	945,220	987,100	945,489
Nitrogen (N)	289,186	315,796	346,536	352,218	337,094
Phosphorus (P ₂ O ₅)	140,197	137,369	148,954	154,816	140,180
Potassium (K ₂ O)	21,729	24,328	23,194	33,044	32,587
Sulphur (S)	14,181	19,101	16,097	17,182	17,367
Ag. Lime (2)	8,388	4,817	4,094	3,460	2,088

(1) Source: Canadian Fertilizer Institute, Ottawa

(2) Source: Alberta Agriculture, Edmonton

*Ammonium Sulphate includes 21/20-0-0-24 and 19-3-0-22

**Ammonium Phos-Sulphate includes 16/17-20-0-14/15

The price of phosphate (11-51-0) decreased 10% from the 1989 price of \$379 per tonne (Table XXIV). Phosphate and urea prices in April '91 were similar to 1987 and the price of anhydrous ammonia decreased 19% compared to 1987.

Table XXIV: Average Price of Selected Fertilizers in April

Fertilizer	1987	1988	1989	1990	1991
	\$	per	tonne		
Ammonium Phosphate (11-51-0)	\$351.	\$345.	\$379.	\$351.	\$339
Urea (46-0-0)	232.	225.	257.	231.	237.
Anhydrous Ammonia (82-0-0)*	425.	373.	390.	348.	346.

*applicator included

Source: Agriculture Statistics Branch

d. Extension

Branch staff participated in numerous producer meetings organized by extension staff and agribusiness. In-service training courses were provided to department staff and fertilizer dealers. Extension activities focused on the efficient use of fertilizers. Several poster displays covering a wide range of production topics were produced, with those relating to the "Sustainable Agriculture" theme being most widely requested.

A quarterly newsletter "SOILutions" was initiated to foster the transfer of information between researchers, agribusiness, producers and government personnel. Articles are submitted primarily by Branch staff however, articles prepared by industry agronomists have also been featured. This newsletter has been very well received; in excess of one thousand copies are distributed throughout western Canada.

Doug Penney and Elston Solberg were invited to an international symposium - "The Role of Sulphur, Magnesium and Micronutrients in Balanced Crop Nutrition" in Chengdu, China. Doug Penney attended and presented two papers based on Branch field research. 1) Copper Deficiency - It's Diagnosis and Correction in Cereal Crops and 2) Factors Affecting the Effective Use of Elemental Sulphur Fertilizers in Western Canada.

A video "YIELD SIGNS: Recognizing Nutrient Deficiencies" was produced to aid producers, extension and agribusiness personnel in recognizing nutrient deficiencies.

2. Soil Agronomy Section

Introduction

The main roles of the section are:

- i. to develop and implement applied research and technology transfer programs that define the fertility status of Alberta soils and improve productivity through the efficient use of resources.
- ii. to develop nutrient recommendations for optimum crop production.
- iii. to develop and evaluate cropping and soil management systems that ensure sustained crop production and conserve the soil and water resources.

a. Production Problems of 1990

Disappointing yields that could not be attributed to weather factors reinforced producer interest in developing improved methods for diagnosing and correcting crop production problems. A lack of reliable "critical" nutrient deficiency levels for some nutrients were identified by researchers, extension personnel and producers as limitations to efficient crop production. It is becoming increasingly apparent that integrated agronomic research is required to evaluate and develop cropping systems information specific to major agroecological areas of Alberta.

b. Field Research Projects

The Soils Branch research program expanded significantly in 1990 through the success of research proposals submitted to Farming for the Future and agribusiness. Field experiments are conducted in various agroecological areas in Alberta to:

- i. Identify nutrient deficiencies.
- ii. calibrate and improve soil tests to develop nutrient recommendation models for optimal crop production.
- iii. evaluate the efficiency and environmental impact of new fertilizer technology.
- iv. determine the productivity and sustainability of cropping systems.
- v. study the interactions between crop nutrients, disease and herbicides.

The majority of field research is now at least partially funded by research grants from Farming For The Future, Alberta Agricultural Research Institute and industry. The Alberta Agricultural Research Institute (AARI) has been used extensively to provide a mechanism for Branch staff to access industry funding.

Cominco Ltd., Cargill Ltd., Esso Chemical Canada, Sherritt Fertilizers Ltd., Western Cooperative Fertilizers Ltd., Alberta Canola Producers Commission and Sulchem Products (1989) Ltd. provided approximately \$250,000 for field research projects. With matching funding through AARI, the branch managed or coordinated 132 field research experiments. The matching funding from AARI was effective January 1990 on any remaining funds from industry sponsored projects. Many projects were done in cooperation with one or several agencies in an effort to combine resources and expertise. Cooperators include: Crop Protection Branch, Field Crops Branch, the departments of Soil Science and Plant Science at the University of Alberta and Agriculture Canada research stations at Lacombe and Lethbridge. A research grant provided by Sherritt Fertilizers Ltd. was instrumental in the establishment of agro-meteorological stations at five sites.



Automated collection of soil and climate data at research sites

Laboratory services are an integral part of the field research program. Approximately 55 percent of the total number of soil and plant samples analyzed at the Soil and Animal Nutrition Laboratory originated from the Branch field research programs.

The following is a brief description of Soils Branch research projects and their status.

1. Southern and South Central Alberta

Soil Test Calibration

This project was initiated in 1988 with a Farming for the Future grant (88-0267). Fertilizer experiments were conducted with 3 or 4 crops grown on fallow and/or stubble in the various agro-ecological areas of southern and south central Alberta. Due to budgetary constraints the number of sites was reduced from 16 to 14.

Data will be used to develop fertilizer response curves at the completion of the project.

Intensive Crop Management

This was the fourth and final year of this Farming for the Future funded project (87-0163). Experiments were initiated in 1987 at Lethbridge and Vauxhall. Each site had Katepwa and Fielder wheat, Harrington and Samson barley, and Global and Westar canola. The objective of this project was to determine crop response to rates and types of fertilizer and to evaluate the effect of varying seeding rates and the use of fungicides and plant growth regulators on crop yield and quality. A final report was prepared and presented at the 1991 Soil Science Workshop.

A number of general observations were made over the 4 years:

- * The use of high fertility alone or in combination with other ICM inputs resulted in a marked increase in soil nitrate in the profile over the four years. Nitrate contamination of ground and surface water is a growing environmental concern. Therefore, the practice of applying quantities of N fertilizer in excess of recommended rates remains questionable.
- * Environmental conditions varied from year to year and dramatically influenced crop yield and response to the various ICM inputs. The full ICM treatment frequently produced the highest yields; however, the yield increase over the normal fertility treatment was generally less than 10 - 15%. Although full ICM increased yield, low grain prices coupled with the relatively high input costs resulted in this treatment not being economic.
- * High fertility and high plant populations were the two inputs which showed potential for increasing crop yield.
- * The plant growth regulator was quite effective in reducing crop height and preventing lodging of wheat and barley. It also delayed crop maturity by 5 to 7 days. No lodging occurred with either soft or hard spring wheat or with Samson barley whereas Harrington barley was severely lodged. In a few cases, the plant growth regulator significantly increased crop yield. The fungicide used for cereals was visually effective in suppressing disease however in areas with hot dry summers and low humidity, disease levels were minimal.
- * Several plant growth regulators were tried with canola, but none reduced crop height, lodging or contributed to increased yield. Disease levels in canola were low and therefore, the fungicide did not affect yield. The use of fungicides may be beneficial when disease pressures are high.
- * Farmers considering the use of growth regulators or fungicides should adopt a scouting program to determine the potential for yield loss from lodging and diseases. These products could be used when potential problems are observed rather than on a regular basis.
- * The use of additional potassium, sulphur, and micronutrient fertilizers did not significantly contribute to increased crop yield or quality nor did they reduce lodging or disease pressure in any crop.

Phosphorus Cycling and Soil Testing

A project studying phosphorus cycling in chernozemic and luvisolic soils has been conducted for the past three years, with funding from the Western Grains Research Foundation. In this last year, the focus has been to evaluate a number of phosphorus soil test methods to determine the ability of each to predict crop response to added P fertilizer. Ken Perl, a soils instructor from the Lethbridge Community College, was seconded to work with the Soils Branch on this project. A summary report was prepared and presented at the 1991 Alberta Soil Science Workshop.

The ability of seven soil tests to determine plant available phosphorus (P) was assessed in a greenhouse study. The Bray P1 and Bray P2, Kelowna, Lethbridge, Miller-Axley, Olsen, and a resin extraction method (PSTP) were evaluated using 62 mineral and 2 organic soils (0-12 cm). Soils represented a wide variation in agroclimatic soil zones, pH, percent clay and organic matter, and free lime. Dry matter yield (DMY) spring wheat and canola provided P concentration in tissue (PCONC) and total P uptake (PTOT) data for correlation to soil P. PTOT was better correlated (r) to soil test P than was either DMY or PCONC in canola. In wheat, PCONC gave very low r values, while correlation coefficients for DMY and PTOT were similar to those in canola. The Miller-Axley method remained highly correlated with DMY and PTOT when organic soils were included in the assessment. On mineral soils, Bray P1, Lethbridge, Kelowna, Miller-Axley and Olsen methods achieved similar r values with DMY and PTOT in both crops. Regression equations for soil test P versus DMY and PTOT were essentially linear. However, variation among the regression equations underlined the need for unique calibration curves for each

soil test on a crop-specific basis. Data stratification on the basis of factors that affect available P did not consistently identify which of these factors played a significant role in the ability of the various soil tests to predict available P. However stratification by soil zone resulted in negative correlation coefficients with low absolute values when Bray P2 was compared to DMY and PTOT in zone 1 (Brown soil zone). Other correlative entities and strategies in statistical data analysis must be pursued in order to identify the causative factors of the outlier soils, and ultimately, the most appropriate method(s) of analyzing soils for available P.

A new study has been proposed and approved for field testing a number of P soil tests which gave good correlations to crop response in greenhouse studies. Alberta Agricultural Research Institute, Western Grains Research Foundation, Canola Producers Commission, Cominco, Westco, Sherritt-Gordon and Esso will contribute \$108,000 per year for 3 years commencing in 1991. Up to 44 sites with 3 crops at each site will be used to correlate P soil tests to crop response.

Fertilizer Placement

Research plots were initiated at Foremost, Lethbridge and Claresholm to investigate various timing, rates and placement methods of nitrogen fertilizer. Two rates each of deep banded, broadcast-incorporated and spoke wheel injected nitrogen were pre-plant applied. These were compared to two rates each of in-crop broadcast and spoke-wheel injected nitrogen and various combinations of pre and post-seeded applications.

Overall, significant differences usually were dependent on the amount of soil N and the amount of N added and not on the application method. The high levels of residual N at most of the sites greatly reduced differences between the application methods.

This was the second year of this study and comparative work will continue for another two years. At that time more definite conclusions can be made on the advantages and disadvantages of each method of N fertilizer application.

Crop Response Modelling

Work continued on development and testing of models for crop response to fertilizer application.

For economic evaluation, work with Dr. S.S. Malhi is underway to test models plus response functions were provided to the Department of Rural Economy, University of Alberta for their assessment.

Once the models have been completed, they will be incorporated into the ASANL soil test recommendations and future soil test expert systems.

Evaluation of Diagnostic Techniques

This study was started to improve and develop techniques for diagnosing crop problems. An evaluation of the accuracy and reliability of portable soil test equipment was conducted. Two types of equipment were tested, i) a portable spectrophotometer and ii) portable selective electrode meters. The spectrophotometer was not accurate enough for research needs and not simple enough to produce accurate results if the operator didn't have some chemistry background. The portable ion selective electrode meters were also less than satisfactory in terms of accuracy and reliability.

Other techniques under review include remote sensing, plant tissue analysis, Diagnosis and Recommendation Integrated System (DRIS) and computerized expert systems.

Soil Test Database Summary

A summary of fall 1990 soil samples indicated low levels of soil test N in stubble fields across the province. Soil test N under annual grain stubble was consistent with long term statistics, but was significantly lower than in 1989. Approximately 80% of soil samples from dryland grain stubble had less than 25 lb N/ac in the 0-6" depth.

A computerized system was designed to generate geographic maps of the province to summarize the spatial distribution of soil fertility factors using the soil test database. Results were presented at the PID Research Conference, March 1991. Work is under way to produce regional maps.

2. Central and Northern Alberta

Intensive Crop Management

This was the fourth and final year of this Farming For The Future funded project (87-0163). Two varieties of wheat, barley and canola were grown in a continuous crop rotation system at Calmar. Each variety was grown at 2 levels of fertility and 2 plant populations with various combinations of fungicides and plant growth regulators. The following conclusions were reached.

- * Fungicide application often increased yields despite relatively low disease levels at the time of application.
- * Fungicides frequently delayed maturity (or prevented early senescence) by 3 to 7 days especially on the high fertility plots.
- * Plant growth regulators greatly reduced lodging of the taller varieties and occasionally delayed maturity however yield increase were seldom realized.
- * Increased plant populations had little or no effect on yield.
- * Application of nutrients beyond that recommended by soil testing did not increase yields and often increased lodging of susceptible varieties.
- * High rates of nitrogen did not increase soil nitrate levels below the 30 cm depth.

Diagnosis and Correction of Copper Deficiency

Copper deficiency may be reducing crop yields on an estimated three million acres of farmland. Requests for information from farmers and extension staff regarding copper sources, and method and rate of application have identified the need for more research on copper fertility. This project was significantly expanded in 1990 through increased funding from Sherritt Gordon Ltd., Alberta Agricultural Research Institute and the Soils Branch.

Copper deficiency cannot be identified on the basis of soil or plant tissue tests alone. It has been observed that soil texture, percent organic matter, application of manure, diseases and herbicides can all interact to influence the severity of copper deficiencies. It is also known there are large differences in crop and varietal sensitivity to copper deficiency. Results from research trials (Figures 22 and 23) have shown increased yields of 20 to 40 percent from a single application of copper.



Melanosis (darkening) and large reduction in grain yield resulting from copper deficiency.

Figure 22: Response of Five Barley Varieties to Copper - Stoney Plain - 1990

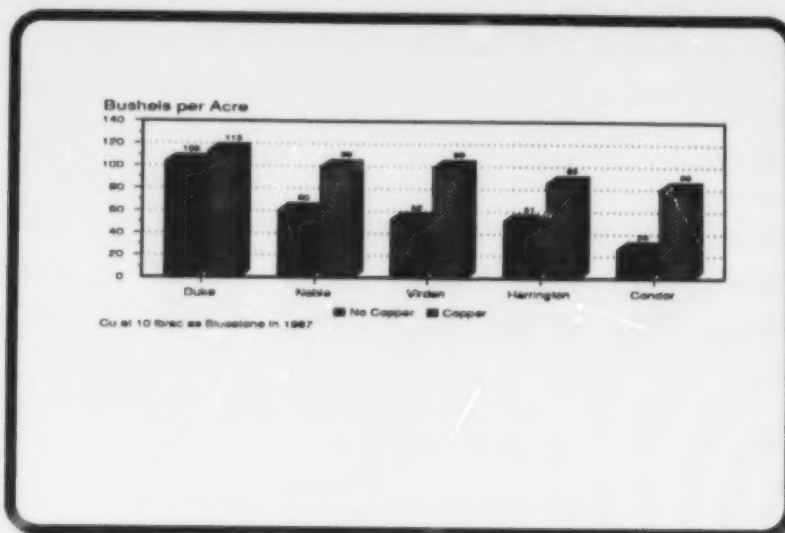
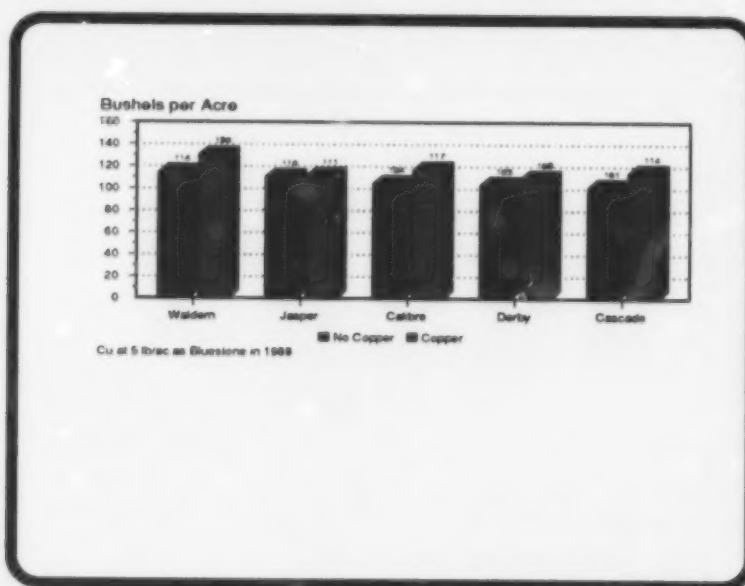


Figure 23: Response of Five Oat Varieties to Copper - Millet - 1990



Calibration of Fertilizer and Other Inputs for Maximum Economic Yield

The existing database for determining nutrient recommendations for barley and oats is based on research completed over 20 years ago. Development of newer varieties of crops, increased use of pre-emergent herbicides and changes in cultural practices have identified a need to update this database. Three years of this project have been completed using Harrington barley and three years are now planned using Calibre oats. The objectives of this project are:

1. to determine the optimum rate of nitrogen and phosphorus for current varieties of barley and oats.
2. to determine the effect of chloride, fungicides and plant growth regulators on the yield and quality of barley and oats.

Interim results from this project have been used extensively at extension meetings and in the preparation of reports.

Improvement of Yield and Quality of Oats Through Split Nitrogen Applications

Three trials were established to determine if mid-season application of nitrogen is an effective means of optimizing crop yield when nitrogen is limiting crop development. This project was developed in response to inquiries from farmers who, because of ideal climatic conditions, are considering applying additional nitrogen. The objectives of this project are:

1. to determine the most effective method of nitrogen application in established stands of oats.
2. to determine the most effective timing of post-seeded nitrogen application on yield and quality of oats.

This project is funded jointly by Cargill Ltd., Alberta Agricultural Research Institute and the Soils Branch.

Tillage, Straw and Fertilizer Nitrogen

Three projects, entering their 8th to 11th cropping seasons at the University of Alberta research farms at Ellerslie and Breton have maintained the same tillage/straw/N management system since establishment of the trials. These studies provide a unique opportunity to examine the long-term effects of cropping systems on productivity and soil quality under experimentally controlled conditions. One project has been modified to incorporate spoke wheel application of fertilizer N. Spoke wheel equipment may be an effective method of fertilizer application in zero tillage systems, forage stands, in established cereal and oilseed crops and in fall fertilization when minimal disturbance of the soil is desired.

Results from these trials (Figures 24 and 25) show percent organic matter was highest in the zero tillage treatments at both locations. Addition of nitrogen increased soil organic matter at both locations under all tillage regimes. Fall applied nitrogen was superior to spring application at both sites and with all tillage treatment with the exception of the Breton site where straw was removed in the conventionally tilled treatment. Data from these experiments have been used extensively in extension meetings, research papers and reports at workshops.

Figure 24: Effect of Tillage and Straw Removal on % Organic Matter in Spring '89 - Breton, Alberta

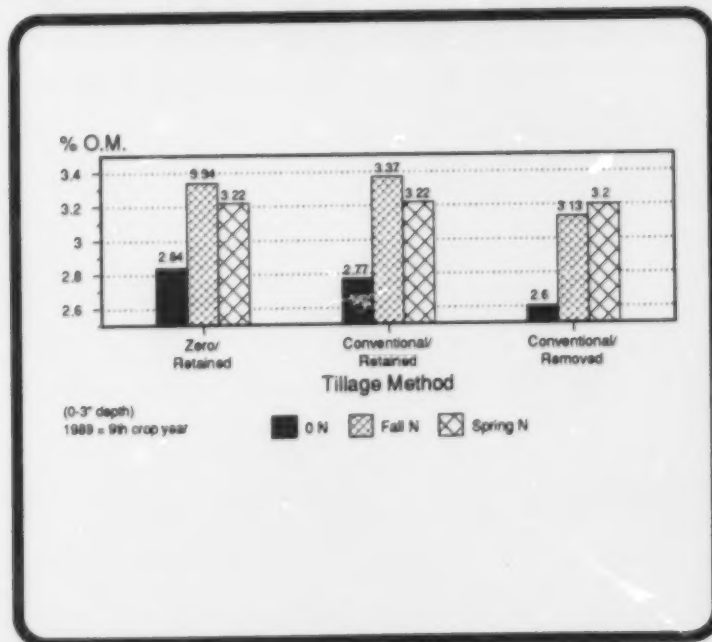
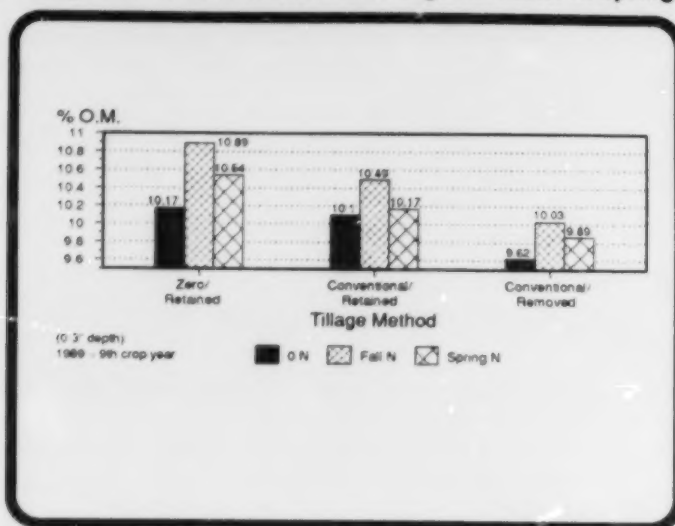


Figure 25: Effect of Tillage and Straw Removal on % Organic Matter in Spring '89 - Ellerslie, Alberta



Evaluation of Coated Urea Fertilizers

Slow or time release fertilizers may maximize plant use efficiency and minimize potential losses of nitrogen due to leaching and denitrification. With some fertilizer materials, slow release forms could allow the entire crop requirement to be placed in the seed row. This would be most advantageous in minimum and zero tillage systems.

In 1990, the second year of field testing of coated urea was completed at three sites. This project is funded by Esso Chemical Canada, Alberta Agricultural Research Institute and the Soils Branch.

Improving the Efficiency of Urea Fertilizer

In 1990, a project was initiated to study the effect of a new urea formulation on crop use efficiency. Field data from 4 sites will be supplemented with a laboratory study. In addition to the above, timing and placement of the fertilizer is also under investigation. This project is funded by Sherritt Gordon Ltd., Alberta Agricultural Research Institute and the Soils Branch.

Correction of N and S Deficiencies in Canola with Post-Seeding Fertilization

The Alberta Canola Producers Commission along with Alberta Agricultural Research Institute and the Soils Branch is funding a new 3 year project to evaluate post-seeding applications of nitrogen, sulphur and a combination of nitrogen and sulphur on yield and quality of canola. Foliar, broadcast, dribble bands and spoke wheel application of nutrients are being evaluated in this project. Two trials were established near Rimbey and a third near Mundare.

Preliminary results show post-seeding fertilizer applications were effective in restoring yield and crop quality with little difference between methods of application (Table XXV).

Table XXV: Effect of Time of N and S Application on Canola									
Fertilizer lb/ac			Yield b/ac						
Preseed			Postseed						
N	S	B	N	S	Thomas North	Thomas South	Mundare		
0	20	0			38.6	34.9	17.1		
90	0	0			33.5	22.5	24.4		
90	20	0			40.3	43.4	26.4		
90	20	1			42.1	39.5	28.1		
73	0	0	17	20	42.2	38.8	29.5		
30	0	0	60	20	41.6	39.9	28.6		
30	20	0	60	0	45.0	43.1	29.4		

Five sites testing moderately deficient in S and moderately deficient to adequate in N gave sharp reductions (7 to 21 bu/ac) in yield when N was applied without S. These results emphasize the need to carefully balance N/S fertility to achieve optimum crop production.

In addition to the above, all sites tested low for soil boron but none responded to boron fertilizer. Further research is required to determine critical boron deficiency levels and to correlate those with crop response.

Relative Efficiency of Acid and Ammonium Phosphate Fertilizers

1990 was the second year of a 3-year project to compare acid phosphate fertilizers with conventional ammonium phosphate. This project includes field, laboratory and greenhouse studies to evaluate the relative effectiveness of these materials. The project is funded by Sherritt Gordon Ltd., Alberta Agricultural Research Institute and the Soils Branch.

Evaluation of New Elemental Sulphur Fertilizers

Research is underway to evaluate two new elemental sulphur fertilizers. This research is being funded by Sulchem Products (1989) Ltd., Alberta Agricultural Research Institute and the Soils Branch. Laboratory and field trials over a 3 year period will determine the effectiveness of these products under Alberta conditions. Laboratory incubation studies show that Sulgro 68 (a form of elemental sulphur) is rapidly oxidized in the soil (Table XXVI).

Table XXVI: The Effect of Method of Application of Elemental Sulphur Fertilizer in Laboratory Incubation Studies											
		Ellerslie Soil					Canwood Soil				
		SO4-S Recovery					SO4-S Recovery				
Sulphur Source	How Applied	Days Incubated					Days Incubated				
		14	21	28	26*		14	21	28	28*	
Sulgro 68	Band	37	39	32	86		30	43	43	94	
	Broadcast	34	44	42	84		44	42	41	171	
	Surface	56	72	104	149		60	91	109	186	
Sulgro 95	Band	4	5	6	54		2	4	2	61	
	Broadcast	5	9	12	75		17	25	27	114	
	Surface	23	40	34	120		31	79	95	139	
Tiger 90	Band	1	3	2	7		0	0	1	5	
	Broadcast	2	5	2	8		0	1	1	8	
	Surface	1	4	3	7		0	3	5	8	

*21 days plus 7 days after sieving through a 2 mm screen to simulate field tillage

Results (Table XXVII) show Sulgrow 95 provided similar yields to ammonium sulphate. Sulgrow 68 was less effective in increasing yield of canola than was Sulgrow 95.

Table XXVII: The Effect of Method and Rate of Application of Elemental Sulphur Fertilizers on Canola Field Trials				
		Appl'n Method	Rate (lb/ac)	Yield (bu/ac)
Check				3.4
N only		Band		2.5
Ammonium Sulphate		Band	1.0	3.7
		Band	3.0	3.9
Sulgro 68		Band	1.0	2.9
		Band	3.0	3.4
		Post-seed	1.0	3.4
		Post-seed	3.0	4.1
Sulgro 95		Band	1.0	3.8
		Band	3.0	3.6
		Post-seed	1.0	3.5
		Post-seed	3.0	3.8
Tiger 90		Band	1.0	2.8
		Band	3.0	2.9
		Post-seed	1.0	2.6
		Post-seed	3.0	3.2

Maximizing Forage Production through Optimal Management of Nitrogen

This project is coordinated by Dr. S. S. Malhi, Agriculture Canada, Lacombe to evaluate various sources, timing and method of application of nitrogen fertilizers on forage crops in central Alberta. Broadcasting, surface banding, knifing and spoke wheel injection are being evaluated at 4 sites. If similar agronomic results from the placement of fertilizers in forage stands can be obtained as with the cereal and oilseed crops, there is considerable potential for increased forage production from adoption of this technology. This research could then be extended to fertilization with phosphorus and potassium.

Relationship of Topsoil Depth to Soil Productivity

This province-wide long-term cooperative study was established at 6 sites to determine:

- the effectiveness of fertilizers and manure in restoring soil productivity and soil characteristics on eroded soils.
- production constraints associated with erosion.

Four sites are located in southern Alberta and managed by Agriculture Canada, Lethbridge. Two sites are located in North Central Alberta (Josephburg and Cooking Lake) and are managed by the Soils Branch and the University of Alberta. Greenhouse and laboratory studies will supplement the field research.



Topsoil removal (simulated erosion), fertilizer and manure treatments resulted in large differences in crop yield.

Diagnosis and Correction of Manganese Deficiency

An oat variety trial established in 1990 by the Plant Science Department, University of Alberta showed symptoms typical of manganese deficiency. This trial showed considerable differences between varieties in their tolerance to manganese deficiency. Research is being proposed:

- i. to establish critical manganese soil test values.
- ii. identify areas of manganese deficiency.
- iii. to establish crop and varietal tolerance to manganese deficiency.
- iv. to evaluate rates, timing and methods of placement of manganese fertilizer.

The diagnosis of manganese deficiency on this oat trial at the University of Alberta, Ellerslie farm is significant in that it occurred on a common soil type not known to be deficient in manganese. The extent to which manganese deficiency reduces yields of various crops and varieties in the province is unknown.

3. Soil Improvement Section

Introduction

The main roles of this section are:

- i. to develop and improve crop production on acid, solonetzic luvisolic and organic soils and to implement applied research and technology transfer programs.
- ii. to develop nutrient recommendations for cereal, oilseed and forage crops grown on organic soils.
- iii. to evaluate the potential use of municipal and industrial by-product materials on agricultural soils.

Main Activities

Numerous research trials were established throughout central Alberta to evaluate deep tillage and the use of amendments on solonetzic soils, subsoiling luvisolic soils, liming acid soils, and deep plowing and fertility of organic soils. Research results were distributed to cooperating farmers and agencies and formed the basis for preparation of factsheets and presentations at farm meetings, conferences and workshops. Staff have also provided a diagnostic service to farmers to identify problems limiting crop yields.

a. Solonchic Soils

Two years of discussions with representatives of the fertilizer manufacturing industry, the University of Alberta and staff from various departments and agencies of government culminated in the finalization of a research proposal to evaluate the environmental effect of using phosphogypsum as a soil amendment. Phosphogypsum is a by-product from the manufacturing of phosphate fertilizer and is stockpiled at fertilizer plants at Calgary, Fort Saskatchewan, Redwater and Medicine Hat. Preliminary results from research trials have shown this material has increased crop yields on some soils however the potential for uptake of radionuclides and heavy metals by crops and the potential for these constituents to enter the groundwater system requires further research. This research proposal includes laboratory and field components. The University will be responsible for completing the laboratory project which will study the fate of radionuclides and heavy metals when added to the soil while the field project will verify laboratory findings and assess uptake of these constituents by crops. The Alberta Environmental Research Trust will match industry funding to provide in excess of \$130,000 per year for each of the 5 years of the study.

Crop response to deep plowing, subsoiling and the application of lime and phosphogypsum was measured at 30 locations. The response of wheat to deep plowing and subsoiling is presented in Table XXVIII. A large increase in yield of wheat in the black soil zone from deep plowing is not typical of data from previous years. These results generally show crop response to deep tillage is greatest in the high precipitation areas (gray soil zone). Two subsoiling trials were established in the County of Leduc to establish a larger data base for the black soil zone.

Table XXVIII:		1990	Wheat	Response
to Deep		Plowing	and	Subsoiling
Soil	Zone	Deep Plowed		Subsoiled
Brown		2.1	(3)*	1.2 (3)
Dark	Brown	8.2	(5)	2.8 (6)
Black		32.9	(1)	4.3 (3)
Thin	Black	3.7	(1)	4.8 (3)
Gray		-----		6.5 (1)
(*) represents		number	of	sites

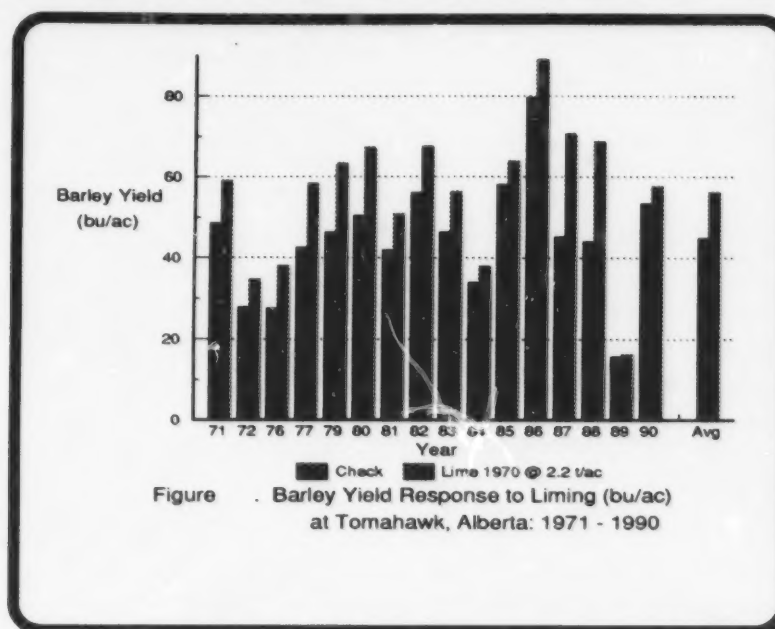
b. Luvisolic Soils

Two subsoiling trials on luvisolic soils were monitored in 1990. At these locations, an exceptionally dry fall in 1989 did not result in any significant storage of moisture in the soil and consequently crop growth was dependent on growing season precipitation. As a result no significant response to subsoiling was obtained at either site. Research has shown crop responses are greatest when moisture which is stored in the soil from snowmelt and periods of excess precipitation is utilized during periods of drought or when improved soil drainage results in less drowning of the crop during periods of excess moisture. Research is underway to identify the soils most likely to respond to this improvement technique and to determine its economic feasibility.

c. Acid Soils

Monitoring of long term liming trials evaluating rates and types of liming materials was continued in 1990. Results from these trials show increased yield of barley averaged 12 bushels per acre per year (Figure 26) and that the effect of liming will last 10 to 15 years.

Figure 26: Barley Yield Response to Liming (bu/ac) at Tomahawk, Alberta - 1971 - 1990



d. Land application of industrial by-product materials

Several meetings were convened with representatives of industry and Alberta Environment to discuss potential application of municipal and industrial by-product materials to agricultural soils. It was agreed that materials that enhanced crop production and did not adversely affect soil, water and crop quality should be applied to land rather than disposed of in landfills.

e. Organic Soils

Nutrient requirements of cereal and forage crops grown on organic soils was determined at 11 locations in west central Alberta. The objective of these trials is to develop soil test calibrations to provide farmers with nutrient recommendations for crops grown on organic soils. Preliminary results have shown that mineralization of organic matter releases insufficient nitrogen for optimum crop yield. Phosphorus has reduced lodging and increased rooting, tillering and maturity. These trials have shown a balanced fertility program including nitrogen and phosphorus at rates between 20 and 60 lbs/ac is required to optimize yield and grain quality. Crop response to large one-time applications of potassium in combination with annual applications was assessed. Results have shown that large applications of potassium are uneconomic and that potassium is subject to leaching in these soils.

Two trials assessing nitrogen, phosphate and copper requirements of forage crops were established in October 1990. Yield and quality of forage will be monitored in succeeding years.

Copper fertility of organic soils was assessed at 6 locations. Indications are that most organic soils are deficient in copper and therefore the objectives of this research is to determine crop response to rates and forms of copper and to determine the longevity of fertilization with copper. At one location the interaction between copper and manganese was evaluated. Results have shown increases in yield up to 25 bu/ac of wheat and barley have been obtained from the application of 7.25 lbs/ac of copper (30 lbs/ac copper sulphate). In addition to yield, copper increased kernel size and reduced the incidence of ergot. Research has shown manganese and high nitrogen fertility during seed formation may reduce copper availability and hence crop yield.

Crop response to lime was assessed at one site. Results from this trial have shown liming enhances forage establishment on acidic relatively undecomposed soils.



Site showing the effect of N and P application on organic soil

4. Laboratory Services Section

Introduction

The Agricultural Soils and Animal Nutrition laboratory (ASANL) has four major objectives.

1. To identify and develop diagnostic and routine laboratory methodologies in soil, plant and animal feed analyses, as required by crop and animal producers to maintain and improve economic and environmental viability.
2. To transfer results of research and development to producers, directly and through private sector laboratories, agri- business and department extension, and thus ensure the farming public access to the latest technology and recommendations.
3. To provide basic diagnostic and analytical services to private and public research and extension institutions.
4. To participate as an active partner in multi-disciplinary applied research.

Staff were involved in three major programs: Laboratory Services Program; Field and Laboratory Research; Technology Transfer.

a. Laboratory Services Program

The laboratory provides:

1. Analyses and Recommendation Services to Alberta farmers and other producers for the economic maximization of crop and animal production.
2. Diagnostic Services to Alberta Agriculture staff to enable efficient extension and advisory functions to farmers, greenhouse operators and other producers with special soil, crop and animal problems.
3. Research Analyses Services to public and private agency researchers for projects directed toward the improvement of crop and animal production.
4. Reference Laboratory Services to private sector laboratories for the purposes of cross referencing methodologies, confirming analyses on unusual samples and quality assurance.

Tables XXIX and XXX show that during this fiscal year the laboratory processed a total of 22,739 soil and 18,818 plant and feed material samples. These figures represented a 36.7% increase in soils and a 10.4% increase in plants and feed materials samples from 1989-90. These differences are attributed mainly to increases in the respective research sample submissions.

Table XXIX: Farmer, Research and Other (Diagnostic, Garden, Greenhouse) Soil Samples Received and as Percentages of Total Soil Samples for Specified Periods

Period	Soils					
	Farmer (%)		Research (%)		Other (%)	
1987-88	3,337	(21.8)	7,927	(51.7)	4,061	(26.5)
1988-89	2,616	(14.4)	11,576	(63.6)	4,005	(22.0)
1989-90	2,443	(17.0)	7,766	(54.0)	4,185	(29.0)
1990-91	1,707	(7.5)	14,469	(63.6)	6,563	(28.9)

Table XXX: Farmer, Research and Diagnostic Plant and Feed Materials Samples Received and as Percentages of Total Plant and Feed Materials Samples for Specified Periods

Period	Soils					
	Farmer (%)		Research (%)		Other (%)	
1987-88	2,524	(19.5)	7,209	(55.8)	3,189	(24.7)
1988-89	2,175	(18.0)	6,577	(54.5)	3,312	(27.5)
1989-90	2,016	(12.0)	11,312	(67.0)	3,538	(21.0)
1990-91	1,810	(9.6)	13,709	(72.9)	3,299	(17.5)

Comparison of 1990 - 91 data with the three previous fiscal years shows a continuing decline of farmer submissions of both soils and plant and feed materials samples. Diagnostic sample submissions were more consistent from year to year. However, soil samples in this category have shown a marked increase for 1990-91 as compared to the previous years. Research samples have shown a consistent increase and now represent 68% of total sample receipts.

Tables XXXI and XXXII show respectively the numbers and types of analyses conducted on soils and plant and feed materials samples for the fiscal years 1987-88 to 1990-91.

A regular analysis package for farm and garden soils consist of analyses for nitrogen, phosphorus, potassium, sulphur, pH, salinity, texture and free lime. For greenhouse soils a regular package includes analyses for texture, pH, salinity, ammonium, nitrate, nitrites, chloride, sulphur, phosphorus, potassium, sodium, calcium and magnesium.

A regular analysis package for plant and feed materials consists of the following:

Whole grains - bushel weight, moisture, protein, phosphorus.

Roughages - moisture, protein, calcium, phosphorus, fibre (ADF), nitrate, pH (silage only).

Mixed feeds (processed grains and grain and supplements with less than 25% roughage) - moisture protein, calcium, phosphorus.

The numbers of analyses conducted by the laboratory in 1990-91 reflect the change in sample type submissions. With increased soil and plant and feed materials sample submissions there is a corresponding marked increase in the numbers of analyses of various types.

Analyses of research project grain and straw submissions were greatly facilitated by the use of near infrared reflectance spectroscopy.

Table XXXIII provides a summary of the 1990-91 research projects analyses program. A total of 46 applications were approved. The laboratory received a total of 28,089 samples from these projects compared to 22,335 samples during 1989-90.

Table XXXI: The Number and Types of Plant and Feed Materials Analyses for the Specified Periods

Analyses	Period			
	1987-88	1988-89	1989-90	1990-91
Regular Package+	12,922	12,064	16,866	18,818
Carotene	126	56	80	55
Prussic Acid	15	4	23	0
Salt	482	313	183	37
Crude Fat	374	212	621	1,744
Ash	1,185	592	208	180
Acid Detergent Insoluble Protein (ADIP)	490	676	368	430
Crude Fibre	40	187	55	25
Neutral Detergent Fibre (NDF)	865	635	1,967	942
Lignin	799	605	314	154
Sodium (Na)	249	1,275	2,665	2,126
Potassium (K)	1,595	1,764	4,839	3,566
Magnesium (Mg)	681	1,822	4,272	2,899
Sulphur (S)	1,384	1,888	4,985	5,047
Selenium (Se)	1,226	1,564	2,552	2,146
Iron (Fe)	730	1,685	4,021	4,190
Manganese (Mn)	1,886	2,945	4,781	4,776
Copper (Cu)	1,999	3,011	5,158	7,694
Zinc (Zn)	1,626	2,988	5,015	6,382
Boron (B)	929	1,322	923	2,393
Molybdenum (Mo)	217	1,506	1,790	1,025
Cobalt (CO)	---	1,202	1,670	761
Aluminum (Al)	8	1,198	1,868	1,808
Miscellaneous*	19	71	260	4,879
Totals	29,849	39,585	65,486	72,077

+ See Text

* Other analyses include arsenic, cadmium and lead.

- Data unavailable

Table XXXII: The Number and Types of Soil Analyses for the Specified Periods

Analyses	Period			
	1987-88	1988-89	1989-90	1990-91
Regular Package+	15,325	18,197	14,394	22,739
Lime	1,762	135	300	404
Organic Matter	2,003	2,918	2,013	1,661
Ash	537	107	421	547
Mechanical Analysis	378	99	264	408
Water Absorption	---	7	1	0
Bulk Density	187	96	80	0
Sodium Absorption Ratio (SAR)	---	380	213	321
Exchange Capacity	---	171	35	180
Moisture	---	822	188	0
Total Nitrogen (N)	---	341	714	335
Total Phosphorus (P)	---	147	144	0
Total Sulphur (S)	---	1	0	277
Ammonium (NH ₄)	---	6,002	3,851	6,939
Calcium (Ca)	---	1,321	167	507
Magnesium (Mg)	---	1,322	159	669
Chloride (Cl)	---	253	353	445
Iron (Fe)	1,364	3,102	2,358	3,934
Manganese (Mn)	1,336	3,186	2,679	4,654
Copper (Cu)	1,405	3,396	2,859	5,649
Zinc (Zn)	1,329	3,082	2,339	4,589
Boron (B)	1,046	800	355	1,487
Molybdenum (Mo)	341	402	320	739
Miscellaneous*	325	369	352	1,319
Totals	27,338	46,656	34,559	57,803

+ See Text

* Other analyses include aluminum, cobalt, nitrite, fluoride and carbonate/bicarbonate.

- Data unavailable

Table XXXIII: Summary 1990 - 91 Research Project - Sample Analysis Program

Project Number	Researcher and Project Title	Sample Volume	
		Soils	Plants and Feeds
90-001	Dr. Mirza Mohyuddin Calcium uptake by seedless cucumbers during night-time fertilization.	40	8
90-002	Dr. Ross McKenzie Development of fertilizer recommendations for southern and south-central Alberta.	1,115	1,185
90-003	Tom Jensen Annual legume plow down.	938	0
90-004	Tom Jensen Conservation tillage demonstration.	0	448
90-005	Tom Jensen Canola and conservation tillage.	30	0
90-006	Tom Jensen Inter cropping of peas.	45	0
90-007	Tom Jensen High residue fallow systems for soil and wildlife conservaiton.	156	0
90-008	Brendan Casement Nutrient study for woody plants.	192	208
90-009	Dr. S.S. Malhi Levels of trace elements and some other quality parameters as influenced by N fertilization of Meadow Bromegrass grown as pasture.	14	672
90-010	Dr. M. Nyborg Evaluation of coated urea and development of new efficient time-released nitrogen materials.	1,387	721
90-011	Dr. M. Nyborg Chelation of Cu Zn and Mn by polyphosphate fertilizer.	3,388	270
90-012	Dr. M. Nyborg Crop available N as affected by long term cultural methods and time of soil sampling.	159	1,019
90-013	Dr. Colin McKenzie and Judy Butt DRIS analysis of greenhouse cucumbers, alfalfa and corn.	232	182
90-014	Barry Yaremci Heat damage levels in silages.	0	15
90-015	Jerome Lickacz Liming acid soils.	405	0

Table XXXIII (cont.): Summary 1990 - 91 Research Project -
Sample Analysis Program

Project Number	Researcher and Project Title	Sample	Volume
		Soils	Plants and Feeds
90-016	Jerome Lickacz Economic feasibility of deep tillage and soil amendments as solonchic soils.	95	1,979
90-017	Dr. Y. Soon Crop residue management on a gray luvisolic soil.	144	0
90-018	Dr. Y. Soon Crop rotation on gray luvisol.	207	0
90-019	Dr. Colin McKenzie Irrigation management of high yield alfalfa.	41	337
90-020	Dr. Colin McKenzie Irrigation management of lentils.	22	0
90-021	Dr. Colin McKenzie Irrigation management of safflower.	132	48
90-022	Dr. Colin McKenzie Irrigation management of 4 species of grass when grown for seed production.	20	0
90-023	Rick Sherstabetoff Organic soil deep tillage feasibility study.	238	30
90-024	Rick Sherstabetoff Nitrogen, phosphorus and potassium requirements of meadow foxtail grown on organic soil.	140	28
90-025	Rick Sherstabetoff Copper and manganese requirements of cereal crops grown on organic soil.	380	267
90-026	Rick Sherstabetoff Nitrogen and phosphate requirements for cereal crops grown on organic soil.	160	48
90-027	Rick Sherstabetoff Cereal and forage crop response to lime application on an acidic organic soil.	0	0
90-028	Doug Penney Post seeding application of fertilizer N.	0	575
90-029	Doug Penney Soil test recommendations for maximum economic yields.	58	624
90-030	Doug Penney Intensive management systems for barley, wheat and canola production.	144	720

Table XXXIII (cont.): Summary 1990 - 91 Research Project -
Sample Analysis Program

Project Number	Researcher and Project Title	Sample Volume	
		Soils	Plants and Feeds
90-031	Doug Penney Copper fertilizer requirements of deficient mineral soils.	144	1,856
90-032	Elston Solberg Liquid acid P fertilizers.	340	500
90-033	Elston Solberg Oxidation of elemental S fertilizers.	1,918	847
90-034	Mike Clayton Economics of coposting in Alberta.	34	99
90-035	Arvid Aasen Dryland intercropping - silage/pasture.	0	76
90-036	Rick Sherstabetoff Northwest Peat Association.	0	35
90-037	Belinda Choban Response of vegetable crops to fertilizer application.	1,206	490
90-038	George Clayton Field Pea Variety Trial.	67	84
90-039	John Hermans On-farm water management study.	64	115
90-040	Jim Lore and Associates Drayton Valley - soil and forage project. Caroline project.	0	212
90-041	Dr. Gary Mathison Ruminant feed evaluation unit.	0	87
90-042	Kevin Bartinsky Barley variety evaluation and copper fertility trial evaluation on peat soil.	130	35
90-043	Sheila Nolan Rainfall simulation study.	10	0
90-044	Norm Flore Fertilization of forage.	78	0
90-045	Dr. John Kennelly Is cereal silage a viable alternative to alfalfa silage for lactating dairy cows?	0	0
90-046	Dr. S.S. Malhi Forage quality.	372	24
Totals		14,245	13,844
Overall Total		28,089	

b. Research and Development Program

The Research and Development Program involves the development and implementation of new analytical systems as well as laboratory research experiments designed to complement field experiments conducted by Soils Branch.

Projects completed during the past year include: development of a low cost high volume microwave digestion system for elemental analysis of plant and feed materials, expansion of near infrared applications in cooperation with the Animal Nutrition Section, automation of the greenhouse analysis and report generating system, automation of data capture for soil analysis systems, and evaluation of soil incubation techniques to estimate the value of legume plowdown.

Other projects started in 1990-91 which are ongoing include: evaluation of N mineralization potential under minimum tillage systems, development of new mathematical techniques to describe solute movement in soil, adaptation of Hedley extraction methods for routine characterization of soil phosphorus fractions, and publication of a comprehensive laboratory methods manual.

c. The Technology Transfer Program

The Technology Transfer Program extends knowledge and technology to producers, private sector laboratories, extension specialists, and researchers. During 1990-91 laboratory staff were involved in two video projects in cooperation with private sector groups. An instructional video on soil sampling was completed and approximately 500 copies distributed to government and private sector extension specialists in Western Canada. A second project on interpreting soil test results was started and will be distributed in September 1991.

During 1990-91, laboratory staff initiated and administered a sample exchange program with the private sector laboratories in Western Canada. The program is run under the auspices of the Western Environmental and Agricultural Laboratory Association. Administration of the program will be an ongoing function in 1991-92.

ALBERTA TREE NURSERY AND HORTICULTURE CENTRE

SUMMARY

The Horticulture Centre was involved in province-wide extension research and developmental activities relating to horticulture and special crops. At the Centre, existing programs in nursery, seed potato, vegetables, greenhouses and tissue culturing were strengthened and some new programs were introduced. Research and product testing projects were conducted in co-operation with the University of Alberta, Humate[®] of Canada Limited and Alberta Forestry.

The Centre continued to provide leadership to the horticulture industry and its commodity groups including Alberta Market Gardeners Association, Alberta Greenhouse Growers Association, Fruit Growers Society of Alberta, the Seed Potato group and groups within Landscape Alberta Nursery Trades Association. Some of these groups provided funds for research and product testing. Co-operative projects were also conducted with Crop Protection Branch, Soils Branch and Alberta Special Crops and Horticultural Research Center.

BRANCH ACTIVITIES

1. Horticulture Crop Development Section

The section is involved in research, extension and production for the seed potato and vegetable industries, non-commercial horticulture extension and micropropagation pathology.

The major emphasis for the Alberta Seed Potato Program is to encourage and assist in the privatization of nuclear seed potato production. The move toward privatization of nuclear seed potato production continued, resulting in construction of private greenhouses for seed potatoes. One grower constructed a small tissue culture laboratory for production of his own potato plantlets. So far these operations have been successful.

Encouraging results were obtained from research programs on rhizoctonia diseases of potato, studies on Alberta isolates from *Erwinias* causing blackleg and softrot of potato, studies on common leaf spot, blight and berry spot on saskatoons caused by *Entomosporium mespili* and studies on potato virus in *Alstroemeria*.

The vegetable program assisted the vegetable industry in providing research and extension for producers in Alberta. The program encouraged more people to become vegetable growers. Recommendations generated from the results of research trials have built confidence among vegetable growers regarding credibility of information provided.

An extension program for agribusiness and consumers was maintained and the Master Gardener Program was introduced with great success.

2. Nursery Crop Development Section

The section is involved in shelterbelt production and extension, and woody plant research and extension.

Over 1.3 million plants were produced and distributed in 1990. The Centre supplied 1,000 wild roses and 500 trembling aspen seedlings for the 'Alberta Road' project in Hokkaido, Japan. About 750,000 spruce seedlings were produced and Provincial Parks received 15,000 containerized plants for the parks throughout Alberta.

Recommendations were made from the Regional Woody Plant Test program and records and samples were taken from the fertilizer trial on trees and shrubs. Recording of soil moisture and yields of crops affected by shelterbelts continued and data is available upon request. Four issues of "Alberta Nursery Notes" were distributed and some articles from it have been reprinted in other publications. Four pruning courses were given, three at the Centre and one at ASCHRC in Brooks.

3. Protected Crop Development Section

The section is involved in research and development for the greenhouse, seed potato, small fruit and tree seedling industries.

The contact with growers and producers have actively been maintained through individual grower visits, workshops, open houses, courses and newsletters. One full term course 'Greenhouse Crops' was given to students at the University of Alberta and supervision of one M.Sc. student at the Department of Plant Science U of A continued.

Alberta Greenhouse Notes continued to be published as a major information tool to growers within and outside the province.

Research on Humate gave encouraging results. Studies on the control of *Pythium* with *Bacillus* in rockwool grown cucumbers gave excellent results. Studies on interaction of root rot pathogens in *Alstroemeria* and seed transmission of *Fusarium oxysporum* in spinach continued.

Tissue culture laboratory continued to provide service and support to the industry. About 10,000 saskatoon plants were produced for growers and research purposes. Four hundred were sent to Scotland and 100 to the U.S.A. Endangered pincherry species *Prunus pennsylvanica* cvs. Jumping Pound and Mary Liss were successfully multiplied and plants produced. For the seed potato program, the laboratory produced 95,000 plantlets.

Research on micropropagation of pine and spruce continued. Studies on autotrophic micropropagation of potato and propagation of sour cherry gave encouraging results. Excellent results were obtained from rooting improvement studies of micropropagated saskatoons.

ALBERTA SPECIAL CROPS AND HORTICULTURAL RESEARCH CENTER

SUMMARY

The Alberta Special Crops and Horticultural Research Center (ASCHRC) is involved in province-wide extension and research activities relating to all areas of horticulture and irrigated specialty crops, in fulfilling its overall crop diversification mandate. Cooperative research projects are conducted in collaboration with personnel from Agriculture Canada, University of Alberta, other Plant Industry Division Branches and the Alberta Environmental Centre.

The extension activities of ASCHRC personnel support and complement extension services provided by the other Alberta Agriculture staff centered in regional and district offices. Contact with both commercial and amateur horticulture clients is assured by maintaining a close working relationship with the industry, input into advisory committee recommendations, and involvement with grower groups and associations. Staff regularly conduct, teach and participate in short courses and seminars held throughout the province. To ensure rapid exchange of information between the producer and the researcher, staff host commodity oriented field days at ASCHRC and participate in similar field days held elsewhere. Membership and active involvement in commodity advisory groups, Canada expert committees, and industry-based committees permit the dissemination of applied research information to all sectors of the horticulture and special crops industries.

BRANCH ACTIVITIES

The following program reports reflect highlights of the Center's research and extension programs. Further details are available from the Center's Annual Report and the ASCHRC pamphlet series. (See publication sections for a listing of titles).

Extension

All professional staff maintain both a research and extension responsibility. Extension activities can be summarized as follows:

- direct contact with producers, typical of all programs but highlighted in the greenhouse program
- direct contact with industry fieldmen (potato and vegetable program)
- input to industry newsletters
- presentations at conferences, seminars and workshops
- conducting industry field days
- on-farm demonstrations
- publication of ASCHRC newsletters. The Center publishes "FruitFacts" for the fruit industry, the "Processing Vegetable Growers Newsletter", the "Crop Protection Newsletter", and the "Market Garden Newsletter".
- writing of extension publications such as the Vegetable and Potato Production Guide

Special Crops and Agronomy Section

1. Field Crops Program

A province-wide program to evaluate perennial forage varieties was initiated. The Center was responsible for conducting trials at two dryland and two irrigated sites and for compiling data from all sites.

Trials were conducted to investigate the economics of producing grass seed under irrigation and to determine fertilizer requirements for Kentucky bluegrass, tall fescue and perennial ryegrass. These grasses offer potential for turf and pasture seed markets. First year results were encouraging with seed yields averaging over 1100 kg/ha in the perennial ryegrass and tall fescue trials and approximately 800 kg/ha for bluegrass.

2. Soil and Water Agronomy Program

The Diagnostic Recommendation Integrated System (DRIS), which uses nutrient ratios rather than nutrient sufficiency levels to determine nutrient deficiencies, is being investigated. Tissue samples were collected and yields were determined on a number of crops to collect data to develop DRIS standards. Data has been collected on alfalfa, grain and silage corn, and greenhouse cucumbers.

A project on salinity tolerance of turf and forage grasses was initiated. Twenty-six species of turf and forage grasses were grown under irrigation; two dryland sites were also planted. Forage samples will be harvested commencing in 1991, salinity will be monitored and relationships between yield and salinity established.

3. Special Crops Program

A project funded by Farming for the Future, investigated basic agronomic practices and potential yields of over 100 annual and perennial herb and spice crops. The adaptability levels showed that seed crops such as coriander, caraway, dill, fenugreek, lovage and perhaps borage and anise can be successfully grown. Herbs such as the basil, cilantro, summer savory, the bergamots, artemisia, chamomile, sage, chives, tarragon, parsley and the mints can be grown as well.

Various agronomic trials, have identified basic management practices for a number of these crops. Yields and quality of essential oils were determined.

Horticulture Section

1. Vegetable Program

Six-hundred and fifty varieties of 18 types of vegetables were evaluated. Direct seeding and transplanting, dates of planting and successive seeding regimes of many types of vegetable were evaluated.

Four plastic mulches (IRT-76, glossy black, and the biodegradables #19 and #131) were tested for durability and influence on pepper and slicing cucumber production. Total season yield of peppers was significantly higher in the IRT-76 treatment. IRT-76 also provided the best yield response for cucumbers.

2. Fruit Crops Program

A replicated trial was established in 1988 to evaluate types of plant stock of 'Smoky' and 'Northline' saskatoons.

Data recorded in the fall of 1990, included plant height, number and height of suckers. Plant materials being evaluated was established from seed, taken from plant suckers, or propagated clonally via tissue culture.

Ten cultivars of saskatoon were established in a randomized replicated trial in 1988 as well. Both trials are expected to fruit in 1991.

3. Nursery Crops and Ornamentals Program

The Nursery and Crops and Ornamentals program established several new projects in the review period.

Projects were initiated to determine cold tolerance in Tower poplar, artificial hardening of nursery stock, hardening of juvenile plant material, cold tolerance of roots and apical dominance.

The Golden Prairie Arboretum and the Forever Green Pinetum were maintained as reference collections for researchers, industry and the general public.

4. Greenhouse Crops Program

Five cherry tomato cultivars were evaluated for yield and quality and compared to a beefsteak cultivar, 'Caruso'. 'Evita' and 'Cherry Wonder' produced the greatest number of fruit and were the highest yielding cherry tomato cultivars. 'Sweet 100' was the preferred cultivar in sensory evaluation.

Soil cooling of Freisia production beds reduced time to flowering by 2 to 3 weeks, and increased the number of flowering stems for cultivars evaluated. Cooled soils were maintained at 13 - 15°C, while ambient bed temperature were 17 - 22°C.

5. Potato Program

The potato program cooperates in the Prairie Regional Potato Trials to select improved potato cultivars for Alberta's potato industry. Approximately 300 cultivars were grown for evaluation.

At least ten cultural projects were conducted, involving the effects of planting data and spacing on 'Russett Burbank', 'Norchip' and 'Superior', and the effects of high density spacing on 'Norchip' and 'Russett Burbank'.

Crop Protection and Utilization Section

1. Food Processing and Quality Evaluation Program

Research work was initiated with Modified Atmosphere Packaging (MAP), which involves packaging products in altered gas atmospheres that are designed to extend shelf life and retain quality. The program will adapt this technology to fruits and vegetables.

The program provided a significant level of support to other programs, by conducting quality evaluation of vegetables, potatoes, fruit crops and special crops.

2. Horticultural Entomology Program

Biological control of greenhouse insects continued as a major thrust of this program. The minute pirate bug, Orius tristicolor, again proved effective in controlling Western Flower Thrips.

A trial was conducted to assess the resistance of Phytoseiulus persimilis to a range of pesticides. Safers Insecticidal Soap, Vendex, Thiodan, Kelthane, and Moristan were tested at 1x, 2x and 4x label rate, using a slide dip evaluation. The project was partially funded by Red Hat Co-op and is ongoing.

3. Post-Harvest Physiology Program

The new controlled atmosphere storages at the Center were tested, with cabbage being stored as the test crop. The trial identified several atmospheric control problems. These deficiencies in the computer control program have been corrected.

An experimental fungicide, ICIO523, was tested at four rates for effectiveness in controlling fairy ring in turf. Evaluations done in September, indicated a reduction in the number of fairy rings, however this was also the case for the control. Further evaluations will be conducted in the spring of 1991.

4. Regional Crop Laboratory Program

One thousand, two hundred and fourteen disease, insect and plant identification specimens were received in the laboratory. The Center's Information Officer responded to 2,132 phone inquiries and 120 walk-in inquiries.

The laboratory identified several unusual plant disease problems: Zucchini Yellow Mosaic in greenhouse cucumbers, root lesion nematode on alstroemeria, Entomosporium leaf spot on saskatoons, and fungal leaf spots on poplar and aspen. The carrot rust fly, Psila rosae was discovered on garden grown carrots from Calgary.

5. Weed Control Program

Data to support the minor use registration of diclofenil (Casoron 4G) for use on saskatoons, was developed through a trial on three year old saskatoons. Rates of 4.5-9 kg/ha did not injure the crop.

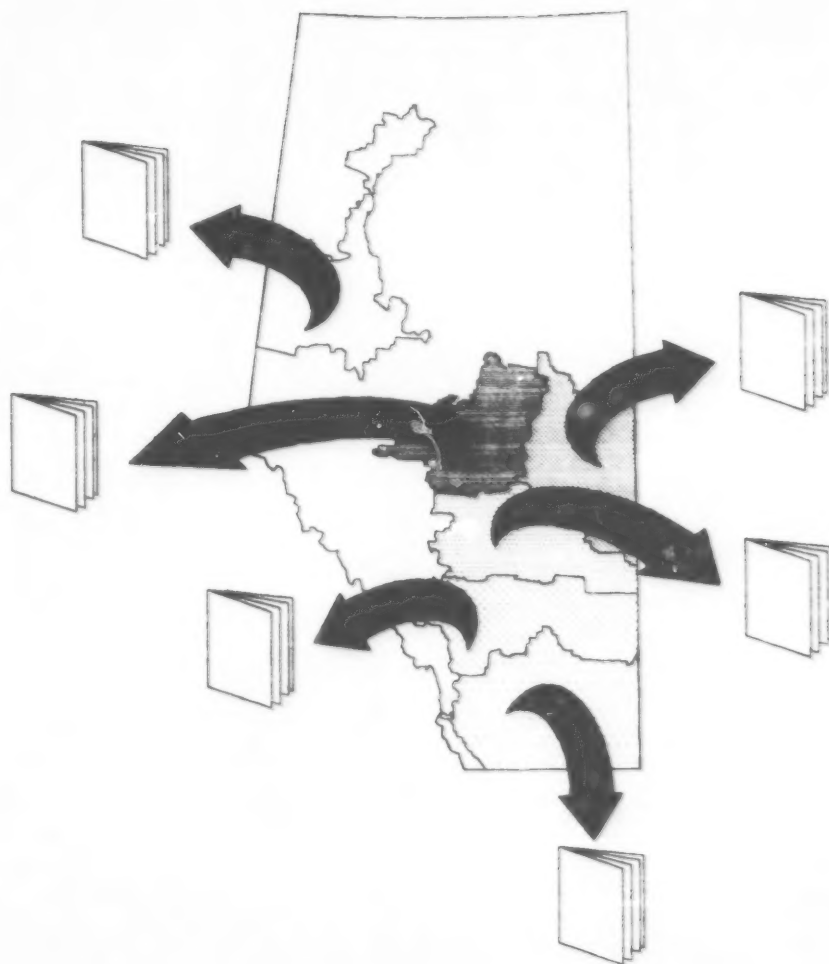
Carry-over of the herbicide imazethapyr (Pursuit) applied at 25-100 g/ha in 1989, was evaluated by planting wheat, canola and potatoes across the plots in 1990. Canola and potatoes were injured even at the lowest rate. Wheat biomass was significantly reduced by residues at or above 50 g/ha. Further recropping will occur in 1991.

6. Plant Pathology Program

Five foliar-applied fungicides were evaluated for their ability to control powdery mildew on Monarda. Plants treated with Bayleton, and Micro-Niasul were lightly infested with mildew and had significantly less disease than those in the check and Funginex-treated plots.

Five greenhouses in Redcliff were surveyed for zucchini yellow mosaic, a new virus disease of greenhouse cucumbers in Alberta. The disease was confirmed in four of the operations. An extensive survey was also conducted for diseases on forage grass seed crops, 23 fields were surveyed.

REGIONAL CROP PRODUCTION REPORTS



REGION 1 - LETHBRIDGE

Blair Shaw, Regional Crop Production Specialist

Serving primary producers has been more of a challenge as the price of farm commodities has fallen both in real dollars and in comparison to the costs of production inputs. The cost of long term activities such as soil erosion prevention have been difficult to justify as individual producers have had to leave agriculture. The challenge has been to develop and recommend low cost but still effective annual procedures which prevent or solve the problem while not costing a lot at the time of implementation. The cumulative effect will be nearly equal but the total final cost is likely to be higher than if everyone could afford to do what is right at the beginning. Recommendations have to be tempered with a new economic reality that incorporates some of the new wave of biotechnology along with the necessity of success to assure financial survival. This is no longer a next year country, its "do or die". Doing something now for future payback is just like summerfallow on irrigation.

Producers mainly concerned themselves with emergent problems such as cutworms in the spring and what now seems to be a recurrent concern, Russian Wheat Aphids (RWA). The RWA seems to be a problem in the seedling winter wheat fields. This last winter, most of the RWA perished in the late winter cold snaps but the damage done in the fall had increased the stress on the winter wheat rosettes to such an extent that wherever RWA were present and not controlled there was severe winter kill which necessitated plowing down those thousands of affected acres.

A stored grain insect, the lesser grain borer was identified in a carlot of grain. Subsequent investigation and trappings have confirmed low numbers of this pest along a line from Taber to Pincher Creek. The cooperation at various government and agency levels was excellent and is a model that goes from the farmer, to the primary delivery point, the Canadian Wheat Board, provincial and federal entomologists and has solved the problem. The type and extent of cooperation is not a daily occurrence, but because of planning, things happen when there is some emergency.

Soil conservation programs of many types including regrassing, deep ripping and living shelterbelts have also been more successful because of the breadth of financial and technical input.

The co-op and private seed cleaning plants in the region have increased their grain handled, area served and their total numbers. The Queenstown Co-op Seed Cleaning Plant is actively planning to relocate and rebuild (from Queenstown to Milo). This plant is moving away from rail service. The success of this plant is due in large part to a vigorous board of directors and a committed manager.

A fire in a private seed cleaning plant/feed mill had originally sparked some interest in establishing a new co-op seed plant but these plans have cooled off.

The long time producer organizations and industry associations have continued and their experience has served as stepping stones for other producer/commodity/processor associations which have become the voice of the industry, such as the Soft White Wheat Growers and the new Winter Wheat Growers Association. These associations have changed the status quo for several crops and have been a two-way entry to and for the industry including the producers. This gateway has increased the rate of adaptation and even changed the directions of new technology.

The interest in organic food production is expanding but much slower than last year. The uncertainty of some of the players in the market has been responsible for some of the slowing of this industry. However, those who are in the industry and have long term faith are now battling with grading, product quality and other obvious challenges.

The entry of a United States based dry bean company has put the excitement back in the bean business. GRIP also has caused lots of animated exchanges.

REGION II - AIRDRIE

Larry Welsh, Regional Crop Production Specialist

The spring of 1990 started normally regarding crop production activities. Before seeding was completed however, a tremendous extreme occurred in the rainfall pattern across the region. While the eastern half of the region received almost no spring rainfall many farmers in the County of Mountain View encountered a delayed seeding period because fields were too wet. By mid-June 10 inches of rain had fallen in that area and the crops that could be planted were delayed throughout the entire crop season. The wet weather in the north-west quadrant of the region also induced a heavy incidence of crop diseases, in particular, barley leaf diseases. Fortunately excellent fall weather enabled crops to be harvested early and farmers for the most part enjoyed good grades.

Crops in the eastern half of the region however, completely dried out and a Disaster Assistance Program for Southeastern Alberta was introduced to soften the blow for affected farmers in that area.

Acreages of most cereals, oilseeds, and specialty crops changed very little from 1989. A slight increase occurred in the spring wheat acreage.

Insect pests were not a significant problem in 1990. While heavy Bertha Army worm infestations were expected, the major problem area was located north of Region II. Only a few fields were sprayed along the northern edge of the region. Russian Wheat Aphid damage was also expected but fortunately did not occur. Grasshopper infestations were heavy however, in the northern half of Special Area #3 and some control was necessary. The most destructive insect pest was the wheat stem sawfly which caused considerable damage in the southern part of the region.

Perennial weeds such as quackgrass and toadflax appeared to deteriorate in those areas where continuous cropping and reduced tillage has increased over the years.

Seed cleaning plants throughout the region enjoyed another good year. A volume of 4,714,978 bushels of seed were processed through the region's 12 plants as of June 30, 1990 (end of the cleaning year). This represents an increase of 9% over the previous year. While the Oyen and Olds plant took advantage of Alberta Agriculture's upgrading grant program, construction of a new replacement seed cleaning plant commenced in September near the town of Three Hills.

Extension courses throughout the winter focused mainly on crop protection. Production courses in general were not popular with the region's farmers as they tended to be more concerned with their financial situation resulting mainly from a poor cash flow. For this reason the Gross Revenue Insurance Plant (GRIP) was of extreme importance to their farming operations and farmers spent many hours studying the various options the GRIP program offered to them before making a final decision of whether or not to enroll and deciding what crops to grow.

The production of a safe food supply and the maintenance of a clean environment has slowly become an issue in the region. Several meetings were held and a display constructed to address misconceptions about modern agricultural practices. The Farmers Pesticide Training Program in 1991 will train and certify farmers to safely apply pesticides. It will be the first course of this kind in Alberta to assist farmers to do their part in addressing the pesticide issue.

The Canada/Alberta Soil Conservation Initiative (CASI) program was made available in the region again for the second year in a row. Mostly all the Agricultural Service Boards took advantage of the funding program to educate and demonstrate the value and need for soil conservation practices. The Alberta Conservation Tillage Society (ACTS) were also users of the program and their presence again made a big impact in the region.

As farmers face another cropping season they do so with a certain amount of intrepidity. The soil profile is very dry throughout most of the region. After eight years of drought farmers in Region II feel 1991 is shaping up to be no different. In spite of it all, they will keep their chin up and try it again!

REGION III - RED DEER

Wayne Jackson, Regional Crop Production Specialist

Moisture was the big factor affecting crop production in 1990. The west third of the region had excessive amounts in the spring resulting in flooded out crops and unseeded fields. The eastern third of the region suffered through their fourth consecutive year of extreme drought. Most producers in the brown soil zone did not combine any grain but salvaged what they could for livestock feed.

Field Crops

Good forage yields were reported in the western districts of the region due to the high spring rainfall. Good summer weather allowed hay to be put up in good condition but the large supply depressed prices. In the drought area, supplies were minimal and feed had to be trucked numerous miles.

Quality of cereals and oilseeds were excellent as the fall allowed producers to get crops harvested with very little delay. However, with depressed prices, financial returns were poor for cereals and most farmers barely covered their costs.

The acreage of field peas increased from the previous year and quality was excellent. Many producers are finding peas to be an excellent crop alternative.

Seed plants had another good year with volume for the region exceeding 5 million bushels.

Westcan Malt company announced the construction of a new malting plant at Alex. Construction began in early 1991 and it is anticipated to be operational in 1992. Producers around Alex are eagerly awaiting completion in the hope of accessing another market for their barley.

Soils & Conservation

Due to poor crops in the eastern districts, straw cover was minimal. Little field work was done during the fall of 1990 and less than average fertilizer and chemical was applied, however wind erosion was substantial.

Counties and producer groups started their CASCI and CARTT programs in 1990. Many hired people just to work on these programs.

Copper deficiency became a concern as several producers tried test strips in fields with excellent results. More research needs to be done on this element.

Pest Control

Grasshopper numbers were high in the eastern end of the region and damage was considerable. Crops did not warrant spraying so little control was evident.

Bertha armyworm numbers increased, but the outbreak was not as bad as anticipated. Several thousand acres were sprayed.

Herbicide resistance was a major concern. Several sites were confirmed of triallate tolerant wild oats and three sites of chickweed resistant to chlorsulfuron were identified.

Horticulture

Market gardening increased in the region. Pick-your-own places are numerous around the cities and do well.

Extension

Extension courses were mainly centered on new varieties and the Guaranteed Revenue Income Protection program announced in early 1991.

Economics

The economic outlook for cereal production remains gloomy. Producer enthusiasm is low and many questions remain as to what to plant for 1991.

REGION IV - VERMILION

Ellis Treffry, Regional Crop Production Specialist

Bjorn Berg, Regional Forage Specialist

Grant Gillund, Regional Soils Specialist

Program development and delivery in North East Region concentrated on actively promoting sound agronomic, economic and conservation practices of annual crops, forages and soil management with an increasing emphasis on integrated information format.

1. Extension Activities

Demonstrations

There was a considerable demand by producers for information on production and management of grasses and legumes in their local areas. This demand has been met by seeding variety trials and demonstrations on a field basis throughout the region. Two forage trials were completed this year, at Bellis and Vermilion. Three new trials were seeded, one on warm season grasses at Provost, and the others in conjunction with the Battle River Forage Association. Other activities included a grazing preference demonstration at Smoky Lake and a demonstration comparing perennial forage and silage of annuals on a feedlot at Lloydminster.

Cereal, oilseed, pulse crops and fertilizer trials were established throughout the Region. These plots/demonstrations involved several agencies including the Agricultural Service Boards, agri-business, Alberta Agriculture staff and individual producers. The number of new varieties available again increased and producers had great interest in examining growth, yield, and maturity in comparison with familiar standards. With these increasing numbers of new varieties, the testing and demonstrations became much more complex and expensive to operate.

Soil compaction continued to be a general concern of producers, particularly those on luvisolic soils. An extensive series of site evaluations were completed to quantify the presence of soil compaction on agricultural fields. Deep ripping was undertaken on several sites to demonstrate the ameliorative effects. A now widely distributed "Field Guide" was prepared for district staff to assist them in evaluating soil compaction and the need for deep ripping.

The use of peas as a green manure plowdown crop was a popular soil conservation demonstration throughout the Region and the relative merits were confirmed by the completion of a three year Farming For The Future project. Two demonstration-research plots were established to evaluate the benefits of field peas in a crop rotation and numerous demonstrations planned for 1991.

Consultations

A disease survey of alfalfa fields was continued in cooperation with the Alberta Environmental Centre. The incidence of crown rot infections and the severity of those infections increased slightly compared to last year.

Ducks Unlimited and the Prairie Care Program played an active role in wetland conservation in the region. Specialists were closely consulted and involved in the field activities, aiding the agrologists and producers with technical information and support.

Another conservation program, the Permanent Cover Program, operated by the PFRA also used department staff, specifically in setting out criteria for stand establishment on seedings in the region.

The Alberta Pulse Growers Commission spearheaded a variety testing program for the region with support of Agricultural Service Boards, regional and district staff. The "Keys to Peas" producer group was formed at St. Paul. Such farmer groups promise to be the leaders in the development of a stable regional pulse industry and will continue to be encouraged with an emphasis on the agronomics of pulse production.

An important role of the Department in the Northeast Region was the support and encouragement to producer groups such as the Stanislaw Sandblasters, Soil Savers, Lakeland Forage Association, East Central Forage Association, Conservation 2000, Alberta Wild Rice Growers and the newly formed Lakeland Agriculture Research Association. Consulting and joint ventures with these organizations continued a growing trend in effectively meeting the specific and specialized needs of producers.

Continued cooperative efforts with Alberta Environmental Centre and the University of Alberta has slowly developed a better information base and understanding of soil compaction in Alberta with research and professional workshops.

During the last year, involvement with Lakeland College expanded considerably with input on joint research projects, revamping of the regular Crops and Machinery curriculum, and establishment of the "student farm" concept.

Three years of cooperative efforts by CARTT, Agriculture Canada and regional staff have resulted in 12 site years of excellent data comparing conventional, minimum till and zero till cropping systems. Limited extension activities are planned for the four site locations during the fall of 1991.

Meetings/Courses/Tours

Numerous producer meetings and seminars were held across the region. Forage topics ranged from forage fertilization and grass seed production to pasture management. Cereal and oilseed production meetings concentrated on variety selection, nutrient fertility, rotations and weed control. Soil Conservation was the topic of a major awareness program with emphasis on reduction of black summerfallow.

Regional staff training included a herbicide update session involving 12 chemical company representatives discussing new and changed registrations, and problems and concerns prior to the spray season. A regional weed inspectors in-service training was held in conjunction with the Alberta Environmental Centre and provincial weed specialists. Weed identification, proposed changes in the Weed Act and duties of a weed inspector were part of that program.

The excellent attendance at the two Regional events, the Sustainable Agriculture Workshop and the Conservation Field Day, can be attributed to the coordination and cooperation of regional and district staff and Lakeland College. This regional cooperation was also evident in the combined efforts of Agricultural Service Boards public awareness programs and particularly the publicity run on TV and radio.

2. Facilitation

Regulation

The seed cleaning plants in Region IV made excellent use of the Provincial Upgrading Program. This enabled the 15 plants to maintain a high standard of operation and service to the producers. All plants in the region were inspected and met the criteria and standards as outlined in the Weed Act. Close liaison was maintained with the Association of Alberta Co-op Seed Cleaning Plants, which is fostering efficiency and cooperation of the seed plants within the region.

Industry Liaison

Close contact was maintained and frequently joint extension meetings were held with agribusiness companies and their representatives. Often chemicals, fertilizers and seed or other products were provided in whole or part by companies to establish trials and demonstrations.

Planning

Region IV specialists were heavily involved in strategic plans this past year. Numerous planning meetings were held with department staff and producers to arrive at goals and priorities for activities within the region.

REGION V - BARRHEAD

Bill Chapman, Regional Crop Production Specialist

Ken I. Lopetinsky, Forage and Special Crops Specialist

Cereal and Oilseeds

Grain production increased due to higher yields and good harvest weather. Crop yields were up 5 to 8% throughout the region and farmers received better grades on wheat and barley. Canola also benefited as oil contents were above average and dockage was lower than normal. The largest contributing factor to these improvements was the hot dry weather in August. Growing season May 1 to August 31 precipitation ranged from a low 4" (101 mm) at Fawcett-Jarvie to 13.5" (340 mm) near Mornville to 17.3" (440 mm) at Leduc.

Wet cool weather delayed seeding by at least 1 week. Farmers in the Warburg-Thorsby areas of the Leduc district were at least 3 weeks late completing seeding. Seeding early and the combination of cool soil temperatures and adequate moisture caused wild oat escapes through pre-emergent herbicides especially on Argentine canola and peas.

It appeared the farmers under financial stress reduced fertilizer rates while more established farmers increased rates based on good moisture levels. Most growers are using complete blends of fertilizer including potash and sulfur (available form). More independent fertilizer dealers as well as Alberta Wheat Pool have added pneumatic and/or floater type applicators to their services.

Total seeded acreage increased to 1,754,273 acres from 1,681,094. Wheat total was 288,478 (crop year 89/90) compared to 205,908 acres (88/89). This total for wheat may be high as the wet spring delayed and reduced wheat acres. Barley - 2 row - 275,932 vs 255,099 and 6 row - 635,960 vs 561,612 acres. This was 95,000 acre increase (11.6%) in barley acreage. Canola dropped to 205,775 acres compared to 313,953. Oats changed to 340,067 from 337,391 acres. These statistics are based on Canadian Wheat Board Seeded Acreage Reports.

No major cropping problems occurred until late July - early August when a major Bertha Army Worm infestation occurred in canola. A total of 35,000 to 40,000 acres in the east half of Barrhead, Westlock and Thorhild as well as parts of Athabasca were affected. Approximately 2,000 acres were sprayed by air as larvae populations ranged from 20 to 35/m² on fields prior to application to 10 - 15/m² on untreated. Producers sprayed more fungicide on Argentine canola limiting the disease potential. Performance was good as a number of ground applied fields were at reduced rates. Those fields accepted control considering the dry weather reduced the disease potential. Root maggots continue to be a problem in canola especially Polish.

Cereal diseases on barley were present but not at high levels experienced in previous years. Increased use of copper in Thorhild, Legal and Barrhead areas also improved grain quality and yields. Malting barley car lots accepted increased to more normal levels. Total numbers were 75 to 80% of the high at 200. A noticeable increase in producer cars also changes this figure positively.

A number of producers also changed their rotations to add more legumes like peas. In addition the canola acreage helped improve crop rotations. These factors and the trend away from Harrington barley to more disease resistant varieties like Duke, Brier and back to Leduc contributed to reduced disease levels.

Seed Cleaning Plants continued their steady progress by cleaning 4,870,000 bushels of grain. The two largest plants continue to be Stony Plain (highest grain volume process), Morinville (most seed processed). The major change was the completion of Morinville's pea cleaning upgrading. The pneumatic system was installed and running. The local board acted as general contractor which made a substantial savings and facilitated complete implementation of innovative changes.

Pedigreed seed sales were good on most varieties. Most growers were concerned over the higher prices charged by the wholesalers of certified seed, but the market driven system paid the premium price for new seed. Unfortunately more farmers kept their seed (a good percentage of registered) for 1991.

Westglenn Mills Ltd. had their grand opening on May 24/91 and expect to be completing final stages of plant operational startup.

Alberta Oats, a smaller oat processing facility at Namo is processing 200 tonnes of oats per day. Their main product lines include dehulled and performance oats.

Forages

Overall, first cut hay and spring to early summer pastures were good. Second cut hay yields in the drier parts of the region were only 1/2 to 1/3 of normal. Late summer and fall pasture growth was very poor and producers were supplemental feeding cattle on pasture in early September. Although there was surplus hay for sale throughout the fall and winter, hay sales were very slow and some surplus still exists even though cattle were on feed as early as September.

Pulse yields were also variable. Fababean yields were well below normal with average yields less than 2000 lb/acre of 1/2 to 2/3 of normal.

Because of the shorter season, newer field pea varieties (90 days to maturity), average pea yields were actually higher in 1990 than in 1989. The drought in July resulted in blasting of the top flowers and yield reduction. Average field pea yield was 40 bu/ac (2,400 lb/ac) although many producers exceeded 3,000 lb/ac yields. Over one-half of total pea production was sold for human consumption.

- 1) Both the Pembina (PFA) and West Central (WCFA) Forage Associations continued their forage extension, demonstrations, and pasture projects in 1990. Both groups are now involved with the CASC program and conservation topics within the associations may be expanded in 1991. The PFA completed the second year of the Pasture Cost Study. Preliminary results suggest that the total variable plus fixed costs of pasturing may exceed \$20/A.U.M. on a 12 to 15 herd survey of some 1,500 to 1,700 cow-calf pairs.
- 2) The 3 dehy plants in the region co-operated in joint alfalfa production seminars. Although second cut yields were below normal, extra acres and good weather contributed to another successful alfalfa processing year. Export markets in early winter were soft, resulting in some concern early in 1991.
- 3) Snowfall was more permanent this past winter, and temperatures throughout the winter were more constant. This resulted in no significant loss of forage acres due to winter kill or damage. All fields look uniform this spring.
- 4) The forage seed industry continues to remain depressed, although legume seed yields in 1990 were better than those experienced in 1989.

Special Crops

Zone 3, Alberta Pulse Growers Commission conducted demonstration plots throughout the pulse growing area of the region. A summer tour of some of the demonstrations and a winter pulse seminar highlighted the year. The CASC pulses for conservation survey and three crop rotation demonstrations were conducted in 1990. This conservation initiative will continue in 1991.

Extension

Extension programs continued to follow District and Regional Strategic Management Plans. The five key priority areas include profit, variety selection, crop and pest management, conservation and balanced fertility programs. Extension activities continue to be a combination of meetings, farm calls, news columns, Crop Notes newsletter, plot tours and district demonstration plot reports. The total number of districts participating is 10 in cooperation with Crop Clubs and Agricultural Service Boards.

Based on the Strategic Management plan for forages and special crops, a total of 9 summer activities and 24 winter activities were carried out. Of these, a total of 11 activities highlighted special crops and 22 activities were devoted to forage quality and yield with emphasis on the dehy industry and dairy forages.

A total of 33 extension activities and 13 on-farm-demo projects resulted in a high profile for forages and special crops in the Northwest Region.



INVENTORY OF RESEARCH PROJECTS





WEED RESEARCH

PROJECT TITLE	TRIAL LOCATION	RESEARCHERS	AGENCY	STATUS AND REPORTED	PMY	TMY
Round-leaved mallow control - in wheat. Biological and chemical	Carsland Rosebud	D. Maurice	Crop Protection Branch	ECW- Research Report 1987 - 1989 (Terminated)	0.007	0.02
Scentless chamomile control - in cereals	Leduc Falher	D. Maurice	Crop Protection Branch	ECW Research Report 1988-1989 Final Report 1990	0.005 0.005 0.005	0.02 0.02 0.02
Established grass tolerance to herbicides	Edmonton	D. Cole	Crop Protection Branch	ECW Research Report 1990	0.0005	0.02
		L. Darwent	Ag. Canada, Beaverlodge			
Alfalfa-brome Establishment - with and without herbicides - with and without a cover crop	Edmonton	D. Cole	Crop Protection Branch	On-going projects ECW	0.02	0.04
		J. Moyer	Ag. Canada, Beaverlodge			
Conservation-fallow	Provost	D. Cole	Crop Protection Branch	ECW Research Report - 1990 CARTT Final Report	0.01	0.02
Canada thistle control - in hayland	Rolly View	D. Cole C. Richardson	Crop Protection Branch	On-going project Expert Committee on Weeds Public Lands	0.01	0.02
Weed Control in seedling alfalfa	Edmonton	D. Cole	Crop Protection Branch	On-going project ECW	0.02	0.04
		L. Darwent	Ag. Canada, Beaverlodge			
Tolerance of seedling grasses to Banvel and Embutox	Edmonton Westlock	D. Cole L. Darwent	Crop Protection Branch Ag. Canada, Beaverlodge	ECW - 1990 Minor Use Project Report	0.01	0.03
		J. Moyer	Ag. Canada, Lethbridge			

WEED RESEARCH (continued)

PROJECT TITLE	TRIAL LOCATION	RESEARCHERS	AGENCY	STATUS AND REPORTED	PMY	TMV
Leafy spurge control with spurge beetles and herbicides	Millet Olds	D. Cole A. McClay	Crop Protection Branch Alberta Environmental Centre, Vegreville	On-going project ECW	0.01	0.03
Ox-eye Daisy Control - in established mixed forage - in established pasture	Buck Lake	D. Maurice	Crop Protection Branch	On-going project ECW Research Report 1988-1989 Final Report 1990	0.005 0.005	0.02 0.02
Control of Toadflax in crop and summerfallow	Wetaskiwin Mannville	D. Maurice	Crop Protection Branch	On-going project ECW Research Report 1988-1989	0.005	0.02
Sulfonylurea - resistant chickweed control	Stony Plain Millet	D. Maurice	Crop Protection Branch	Active Expert Committee on Weeds Report 1990	0.1	0.02
Grassy weed control in field peas	Morinville Ft. Saskatchewan	D. Maurice	Crop Protection Branch	Active Expert Committee on Weeds	0.1	0.02
Broadleaved weed control in field peas cleavers, stork's-bill	Morinville Ft. Saskatchewan	D. Maurice	Crop Protection Branch	Active Expert Committee on Weeds	0.1	0.02
Spreading dogbane control in summerfallow	Red Deer	D. Maurice	Crop Protection Branch	Active Expert Committee on Weeds	0.1	0.02
Pasture Sage Control - in native pasture	Irricana Three Hills	D. Maurice	Crop Protection Branch	On-going project ECW Research Report 1989 Final Report - Terminated Trial	0.005 0.005	0.02 0.02

WEED RESEARCH (continued)

PROJECT TITLE	TRIAL LOCATION	RESEARCHERS	AGENCY	STATUS AND REPORTED	PMY	TMY
Triallate Resistant Wild Oat Control in Cereals	Bruderheim	D. Maurice	Crop Protection Branch	On-going project ECW Research Report 1990	0.1	0.02
Water Smartweed Control	Claresholm	D. Maurice	Crop Protection Branch	On-going project ECW Research Report 1990	0.1	0.02
Tansy Control - in non-cropland - in a grass hayfield - on roadside	Fallis	D. Maurice	Crop Protection Branch	Stony Plain and Athabasca sites - on-going projects ECW Research Report 1987-1989	0.002 0.002 0.002	0.01 0.01 0.01
Scentless Chamomile Control - in established alfalfa - in established red clover	Leduc Bezanson	D. Cole	Crop Protection Branch	ECW Research Report 1990	0.005	0.02
Toadflax Control - in established alfalfa	Stettler	D. Cole	Crop Protection Branch	ECW Research Report 1990 On-going project	0.005	0.01
White Cockle Control - in established alfalfa	Nisku	D. Cole	Crop Protection Branch	ECW Research Report 1990	0.005	0.02
Seedling grass tolerance - to herbicides	Edmonton	D. Cole L. Darwent	Crop Protection Branch Ag. Canada, Beaverlodge	On-going project ECW Research Report 1990	0.01	0.03
Seedling legume tolerance - to herbicides	Edmonton	D. Cole L. Darwent	Crop Protection Branch Ag. Canada, Beaverlodge	On-going project ECW Research Report 1990	0.01	0.03

PATHOLOGY RESEARCH

PROJECT TITLE	TRIAL LOCATION	RESEARCHERS	AGENCY	STATUS AND REPORTED	PMY	TMV
Evaluation of biocontrol methods for Alternaria Blackspot of canola	Olds Edmonton	S. Slopek	Crop Protection Branch (Canola Commission Funding)	Active	0.05	0.25
Screening for smut resistance in barley	Olds	S. Slopek	Crop Protection Branch Co-operative Project	Active	0.35	0.35
Screening for bunt resistance in winter wheat	Olds	S. Slopek	Crop Protection Branch Co-operative Project	Active	0.05	0.05
Analysis of crop protection input interactions. Insecticides, fungicides, and plant growth regulators	Olds	S. Slopek	Crop Protection Branch Co-operative project (within and outside Alberta Agriculture)	Active	0.15	0.35
Barley leaf disease loss assessment. Varietal differences, timing of application, effect of fertilizer.	Olds	S. Slopek	Crop Protection Branch Co-operative project (within and outside Alberta Agriculture)	Active	0.2	0.15
Forage Variety Testing	Olds	S. Slopek	Crop Protection Branch Co-operative project (within Alberta Agriculture)	Active	0.05	0.3

PATHOLOGY RESEARCH (continued)

PROJECT TITLE	TRIAL LOCATION	RESEARCHERS	AGENCY	STATUS AND REPORTED	PMY	TMV
Pulse Varietal and Agronomic Testing	Olds	S. Slopek	Crop Protection Branch Co-operative Project (within Alberta Agriculture)	Active	0.05	0.1
Evaluation of barley leaf disease resistance	Olds Edmonton Lacombe	S. Slopek	Crop Protection Branch (FFF funded)	Active	0.1	0.8
Copper deficiency: crop variety response, disease and herbicide interaction (FFF)	Edmonton	D. Penney I. Evans E. Solberg W. Yarish	Soils, Crop Protection	On-going	0.4	2.9
Split nitrogen application to improve oat quality and yield (AARI)	Edmonton	E. Solberg D. Penney L. Kryzanowski I. Evans	Soils, Crop Protection	On-going	0.5	2.2
Copper deficiency: diagnosis, crops, symptoms, disease, fertilizers (AARI)	Edmonton	E. Solberg D. Penney D. Heaney I. Evans D. Maurice	Soils, Crop Protection	On-going	0.6	2.0

ENTOMOLOGY RESEARCH

PROJECT TITLE	TRIAL LOCATION	RESEARCHERS	AGENCY	STATUS AND REPORTED	PMY	TMY
Correlation of Bertha armyworm larval densities with pheromone trap results	Pheromone trap site throughout Alberta	J. Jones	Crop Protection	Continuing	0.2	0.2
Development of pest management strategies for thrips in barley	Olds	M. Okuda	Crop Protection	Continuing	0.8	0.8

CEREAL AND OILSEEDS RESEARCH

PROJECT TITLE	TRIAL LOCATION	RESEARCHERS	AGENCY	STATUS AND REPORTED	PMY	TMY
Development of new 6-row feed barley varieties for Alberta	Irrigation 1 site	J. Helm	Field Crops	On-going	0.2	2.0
	Area 1, 1 site			Annual report		
	Area 2, 1 site			Field Crops library		
	Area 3, 1 site			Agriculture Library		
	Area 4, 4 sites					
	Area 5, 2 sites					
	Saskatchewan, 1 site					
Development of new 2-row feed barley varieties for Alberta	Irrigation 1 site	J. Helm	Field Crops	On-going	0.2	2.0
	Area 1, 1 site			Annual report		
	Area 2, 1 site			Field Crops library		
	Area 3, 1 site			Agriculture library		
	Area 4, 4sites					
	Area 5, 2 sites					
	Saskatchewan, 1 site					
Development of high lysine and hullless barley varieties which have improved feeding value	Irrigation 1 site	J. Helm	Field Crops	On-going	0.1	0.5
	Area 1, 1 site			Annual report		
	Area 2, 1 site			Field Crops library		
	Area 3, 1 site			Agriculture library		
	Area 4, 4 sites					
	Area 5, 2 sites					
	Saskatchewan, 1 site					
Barley germplasm creation and maintenance	Lacombe	J. Helm	Field Crops	On-going	0.1	0.9

CEREAL AND OILSEEDS RESEARCH (continued)

PROJECT TITLE	TRIAL LOCATION	RESEARCHERS	AGENCY	STATUS AND REPORTED	PMY	TMV
The heritability of straw strength in Samson and other semi-dwarf barleys	Lacombe	J. Helm P. Jedel	Field Crops	On-going	0.1	0.1
Cereal and oilseed regional variety trials on barley, wheat, oats, flax, & canola	Irrigation 4 sites Area 1, 4 sites Area 2, 3 sites Area 3, 4 sites Area 4, 6 sites Area 5, 7 sites Area 6, 5 sites	J. Helm D. Salmon B. Wolfe K. Briggs L. Dosdal S. Kibite H. Najda K. May	Field Crops Field Crops Ag. Canada U. of A. AEC Ag. Canada ASCHRC Ag. Canada	Ongoing, Reported Annual Report Cereal & Oilseeds Advisory Committee Report in all research Libraries in Western Canada	0.1	2.0
Intensive management systems for barley, wheat and canola F.F.F.	Lacombe	J. Helm D. Penney	Field Crops Soils production	Report to FFF	0.1	0.9
Development of new spring triticale and wheat cultivars	Irrigation 1 site Area 2, 1 site Area 3, 2 sites Area 4, 3 sites Saskatchewan, 2 sites	D. Salmon	Field Crops	Ongoing Annual Report Field Crops & Ag. Dept. Libraries	0.2	1.9
Germplasm development and evaluation in spring triticale and wheat	Lacombe	D. Salmon	Field Crops	Ongoing	0.1	0.2

CEREAL AND OILSEEDS RESEARCH (continued)

PROJECT TITLE	TRIAL LOCATION	RESEARCHERS	AGENCY	STATUS AND REPORTED	PMY	TMY
Evaluation of winter cereals for forage potential	Lacombe	D. Salmon	Field Crops	On-going	0.1	0.1
	Brooks	J. Helm	Field Crops	Annual Report		
		V. Baron	Ag. Canada	FFF Report		
Development of improved varieties of winter wheat and triticale	Lacombe	D. Salmon	Field Crops	On-going	0.3	1.8
	Brooks	J. Helm	Field Crops	Annual Report		
	Lethbridge			Field Crops &		
	Olds			Ag. Dept. Libraries		
	Trochu					
Saskatchewan 3 sites						
Germplasm development and evaluation in winter wheat and triticale	Lacombe	D. Salmon	Field Crops	On-going	0.1	0.2
Seeding rate, and date influence on spring triticale	Lacombe	P. Jedel	Field Crops	On-going	0.1	0.1
	Provost	D. Salmon	Field Crops	Annual Report		
	Olds, Trochu			Field Crops		
	Drumheller			Ag. Dept. Libraries		
	Stettler					
Identification of lines of barley, triticale and winter wheat with improved levels of post harvest dormancy	Lacombe	D. Salmon	Field Crops	On-going	0.1	0.2
		J. Helm	Field Crops	Published		
				Crop Science		
Silage production of barley and triticale				Annual Report		
	Lacombe	P. Jedel	Field Crops	On-going	0.1	0.2
		J. Helm	Field Crops	Annual Report		
		D. Salmon	Field Crops	Field Crops &		
				Ag. Dept. Libraries		

CEREALS AND OILSEEDS RESEARCH (continued)

PROJECT TITLE	TRIAL LOCATION	RESEARCHERS	AGENCY	STATUS AND REPORTED	PMY	TMY
Screening barley for resistance to the smuts	Olds	S. Slopek J. Helm	Crop Protection Field Crops	On-going Annual Report	0.4	0.3
Screening barley and triticale for root rot resistance	Lacombe	J. Helm D. Salmon	Field Crops	On-going	0.1	0.4
Screening barley and triticale for foliar disease resistance	Lacombe Calmar Olds Trochu Winnipeg Vegreville	J. Helm D. Salmon F. Townley-Smith P. Kharbanda	Field Crops Field Crops Ag. Canada AEC	On-going	0.1	0.4
Barley cultivar response to some aspects of MEY management	Lacombe	P. Jedel J. Helm	Field Crops	On-going Annual Report	0.1	0.3
Crop rotation in cereals	Lacombe	P. Jedel J. Helm D. Salmon	Field Crops	On-going Annual Report	0.1	0.2
Yield reduction of barley due to lodging	Lacombe	P. Jedel J. Helm	Field Crops	Published Agron. Journal	0.05	0.0
Agronomic assessment of yield in central Alberta of barley cultivars	Lacombe Stettler Olds	P. Jedel J. Helm	Field Crops	On-going Annual Report	0.3	1.3

CEREAL AND OILSEEDS RESEARCH (continued)

PROJECT TITLE	TRIAL LOCATION	RESEARCHERS	AGENCY	STATUS AND REPORTED	PMY	TMY
Drought stress effects on barley and triticale	Lacombe	P. Jedel J. Helm D. Salmon	Field Crops	On-going Annual Report	0.2	0.5
Influence of harvest date/maturity on the yield and seed quality of spring triticale	Lacombe	P. Jedel D. Salmon	Field Crops	On-going Annual Report	0.05	0.1
Forage potential of Wapiti triticale and Johnston barley underseeded to winter cereals for silage and grazing	Lacombe	P. Jedel D. Salmon	Field Crops	On-going Annual Report	0.05	0.1
An evaluation of spring triticale mixtures for silage production	Lacombe	P. Jedel D. Salmon	Field Crops	On-going Annual Report	0.05	0.1
An evaluation of mixtures of pulse crops and cereals for silage production	Lacombe	P. Jedel J. Helm D. Salmon	Field Crops	On-going Annual Report	0.05	0.1
Chemical desiccation to determine drought tolerance in barley and triticale	Lacombe	P. Jedel J. Helm D. Salmon	Field Crops	On-going Annual Report	0.1	0.1

SOIL FERTILITY AND SOIL IMPROVEMENT RESEARCH

PROJECT TITLE	TRIAL LOCATION	RESEARCHERS	AGENCY	STATUS AND REPORTED	PMY	TMV
Intensive crop management systems for wheat, barley and canola production under dryland and irrigation	4 locations	D. Penney	Soils Branch	Complete	1.0	3.0
		R.H. McKenzie	Soils Branch	Farming for the Future		
		E. Solberg	Soils Branch	Program - Final Report		
		J. Helm	Field Crops			
Diagnosis and correction of copper deficiency	7 small replicated 14 field scale strip trials	D. Penney	Soils Branch	On-going. Project funded by Esso, Cominco, Sherritt Gordon Ltd., and AARI	0.5	2.5
		E. Solberg	Soils Branch			
		D. Heaney	Soils Branch			
		I. Evans	Crop Protection			
		D. Maurice	Crop Protection			
		K. Briggs	U of A - Plant Sc.			
		M. Nyborg	U of A - Soils			
Improvement of oat quality and yield through split N applications	3 locations	E. Solberg	Soils Branch	On-going	0.4	1.2
		D. Penney	Soils Branch	Project funded by Cargill Ltd.		
		L. Kryzanowski	Soils Branch			
		I. Evans	Crop Protection			
Calibration of fertilizer and other inputs for maximum economic yield of oats.	3 locations					
Tillage, straw and fertilizer nitrogen: yield, soil quality, N efficiency and environmental impact	5 locations	M. Nyborg	U of A - Soils	Farming for the Future Project	0.4	1.0
		D. Chanasyk	U of A - Soils			
		E. Solberg	Soils Branch			

SOIL FERTILITY AND SOIL IMPROVEMENT RESEARCH (continued)

PROJECT TITLE	TRIAL LOCATION	RESEARCHERS	AGENCY	STATUS AND REPORTED	PMY	TMY
Evaluation of coated urea and development of new efficient time release nitrogen fertilizers	3 locations	M. Nyborg	U of A - Soils	Soils Branch, AARI and Industry (Esso) Funded	0.3	1.4
Improving the Efficiency of Urea Fertilizer Nitrogen	4 locations	E. Solberg E. Solberg D. Penney D. Heaney	Soils Branch Soils Branch Soils Branch Soils & Animal Nutrition Branch	On-going Project funded by Soils Branch Sherritt Gordon Ltd., and AARI	0.3	0.7
Correction of nitrogen and sulphur deficiency with post-seeded fertilizer	5 locations	D. Penney E. Solberg D. Heaney L. Kryzanowski	Soils Branch Soils Branch Soil & Animal Nutrition Lab Soils Branch	On-going Project funded by Soils Branch, Alberta Canola Producers Commission and AARI	0.5	1.0
Relative efficiency of acid and granulated phosphorus fertilizers	4 locations	E. Solberg D. Penney D. Heaney L. Kryzanowski	Soils Branch Soils Branch Soils & Animal Nutrition Lab Soils Branch	On-going Project funded by Soils Branch, Sherritt Gordon Ltd., and AARI	0.4	1.0
Evaluation of new elemental sulphur fertilizers	2 locations	E. Solberg D. Penney D. Heaney L. Kryzanowski	Soils Branch Soils Branch Soils & Animal Nutrition Lab Soils Branch	On-going Funded by Soils Branch, Sulchem (1989) Ltd., and AARI	0.3	0.7
Maximizing forage production through optimal nitrogen fertilizer management	4 locations	S.S. Malhi M. Nyborg E. Solberg	Ag. Canada U of A - Soils Soils Branch	On-going Farming For the Future Project	0.3	0.7

SOIL FERTILITY AND SOIL IMPROVEMENT RESEARCH (continued)

PROJECT TITLE	TRIAL LOCATION	RESEARCHERS	AGENCY	STATUS AND REPORTED	PMY	TMY
Relationship of topsoil depth to soil productivity	6 locations	E. Solberg C. Izzaualde F. Larney	Soils Branch U of A - Soils Ag. Canada	1st year of a long term province-wide project	1.0	4.0
Diagnosis and correction of manganese deficiency	1 location	D. Penney K. Briggs	Soils Branch U of A - Plant Sc.	On-going No outside funding	0.1	0.5
DRIS analysis of forage alfalfa, grain corn, silage corn and greenhouse cucumbers	11 alfalfa 10 grain corn 10 forage corn 18 greenhouses laboratory analysis	R.C. McKenzie J. Butt L. Kryzanowski D. Heaney	ASCHRC ASCHRC Soils Branch Soils & Animal Nutrition Lab	On-going No outside funding	-----	-----
Development and evaluation of fertilizer response models for Alberta crops	Data from RAYP, MEY, irrigated and dryland projects	L. Kryzanowski	Soils Branch	On-going	0.3	-----
Evaluation of diagnostic techniques for crop production	Laboratory	L. Kryzanowski	Soils Branch	No outside funding On-going	0.2	-----
Soil phosphorus cycling and development of a laboratory test for soil phosphorus	Laboratory and greenhouse project	R. H. McKenzie J. F. Dormaar J.W.B. Stewart K. Perl	Soils Branch Ag. Canada U. of Sask. Lethbridge Community College	Western Grains Research Foundation funded Interim Report completed Summary report completed	1.2	1.5

SOIL FERTILITY AND SOIL IMPROVEMENT RESEARCH (continued)

PROJECT TITLE	TRIAL LOCATION	RESEARCHERS	AGENCY	STATUS AND REPORTED	PMY	TMY
Nitrogen fertilizer timing and placement	3 locations	R.H. McKenzie	Soils Branch	On-going No outside funding	0.1	0.4
Fertilizer requirements of dryland crops	16 major locations in Region I & II 3-5 crops per location	R.H. McKenzie H.H. Janzen	Soils Branch Ag. Canada	On-going completed 3rd year of 4 year project. FFF funded	0.5	3.0
Field evaluation of tests for soil phosphorus	Approved for 1991 44 locations	R.H. McKenzie D.C. Penney E. Solberg D. Heaney L. Kryzanowski G. Coy	Soils Branch Soils Branch Soils Branch Soils & Animal Nutrition Lab Soils Branch Field Services	Funding from AARI, WGRF, Canola Producers Commission, Commico, Sherrit-Gordon, Esso, Westco and Soils Branch	2.0	4.0
Assessment of deep plowing, ripping and the application of amendments for improving crop growth on Solonchic soils	53 locations	J. Lickacz	Soils Branch	On-going No outside funding	0.5	0.50
Crop responses to liming and ripping of luvisolic soils	9 locations	J. Lickacz	Soils Branch	On-going No outside funding	0.05	0.05
Nutrient requirements and liming and deep plowing feasibility of organic soils	15 locations	R. Sherstabetoff	Soils Branch	On-going No outside funding	0.7	0.70

VEGETABLE AND POTATO RESEARCH

PROJECT TITLE	TRIAL LOCATION	RESEARCHERS	AGENCY	STATUS AND REPORTED	PMY	TMY
Seed potato density trial	Edmonton	K. Pruski M. Mirza	ATN&HC	Complete ('89)	0.21	1.0
Autotrophic cultures of potato	Edmonton	K. Pruski S. Pietucha M. Mirza	ATN&HC	Complete ('90)	0.2	0.5
Studies on stem canker and black scurf caused by <i>Rhizoctonia solani</i>	Edmonton	P. Bains J. Letal	ATN&HC	Continuing*	0.2	0.8
Tissue culture of seed potatoes	Edmonton	P. Bains J. Letal	ATN&HC	Continuing*	0.2	0.3
Pathogenicity studies on blackleg of potato	Edmonton	P. Bains J. Letal	ATN&HC	Continuing	1.	0.1
Vegetable cultivar trials for cabbage, broccoli, cauliflower, corn, lettuce and chinese vegetables	Edmonton	B. Choban	ATN&HC	Continuing	0.04	0.4
Cos (Romaine) lettuce spacing trial	Edmonton	B. Choban	ATN&HC	Continuing		
Broccoli and carrot fertility cultural trial	Edmonton	B. Choban	ATN&HC	Complete* ('90)		
Transplant nutrient deficiency trial	Edmonton	B. Choban	ATN&HC	Complete* ('90)	0.05	0.2
Grower co-operative trial on cabbage and corn	Peace River	B. Choban	ATN&HC	Continuing	0.1	

* Trial results reported in the Alberta Tree Nursery and Horticulture Centre Annual Report

FRUIT CROPS

PROJECT TITLE	TRIAL LOCATION	RESEARCHERS	AGENCY	STATUS AND REPORTED	PMY	TMY
Association of aphids with saskatoon roots	Edmonton	P. Bains	ATN&HC	Continuing*	0.2	0.3
Micropropagation sathology of saskatoons	Edmonton	P. Bains	ATN&HC	Continuing*	0.1	0.2
Study of common leaf spot, blight and berry spot of saskatoons	Edmonton	P. Bains	ATN&HC	Continuing	0.2	0.1
Production of saskatoons through tissue culture	Edmonton	K. Pruski S. Pietucha	ATN&HC	Continuing (20,000 micropropagated plants were produced from 1987 to 1990)	0.5	2.0
Saskatoon rooting trial (in vitro)	Edmonton	K. Pruski S. Pietucha M. Mirza	ATN&HC	Complete	0.1	0.5
Micropropagation of fruit crops (Mongolian cherries, sour cherries, raspberries)	Edmonton	K. Pruski S. Pietucha M. Mirza	ATN&HC	Continuing	0.1	0.1
Micropathology of saskatoons	Edmonton	P. Bains K. Pruski M. Mirza	ATN&HC	Continuing	0.02 0.02 0.01	
Dormancy in saskatoon plantlets	Edmonton	K. Pruski S. Pietucha M. Mirza L. Ozinek	ATN&HC	Complete	0.2	0.5

* Trial results reported in the Alberta Tree Nursery and Horticulture Centre Annual Report

ORNAMENTALS, TREES AND SHELTERBELTS

PROJECT TITLE	TRIAL LOCATION	RESEARCHERS	AGENCY	STATUS AND REPORTED	PMY	TMY
Nutrient study for woody plants	Edmonton	B. Casement	ATN&HC	Continuing	0.02	0.03
Prairie regional trial for woody ornamentals	Edmonton	B. Casement	CDS Morden	Continuing	0.02	0.02
Regional woody plant test program	Grande Prairie	B. Rogerson		Annually to Committee Advisory meetings, Commodity Group meetings and Annual Report.	0.05	0.1
	Edmonton	B. Casement				
	Bowden	D. Berggren				
	Calgary	H. Heuver				
	Brooks	H. Mathers				
	Coaldale	H. Kuperus				
Plant introduction scheme from the University of British Columbia Botanic Garden	Edmonton	B. MacDonald	U.B.C. ATN&HC	Continuing	-----	-----
		B. Casement				
Humalite trial on poplar cuttings	Edmonton	B. Casement	ATN&HC	Complete	0.01	0.01
		B. Breneman				
Humalite trial in containers	Edmonton	B. Casement	ATN&HC	Complete	0.01	0.01
		C. McIsaac				
Effects of alfalfa pellets on growth of White Spruce and Scots Pine	Edmonton	B. Casement	ATN&HC	Complete	0.01	0.01
		B. Breneman				
All american selections annual flower trial	Edmonton	B. Casement	AAS Committee	Continuing (to AAS Committee annually)	0.01	0.01
Micropropagation of spruce and pine	Edmonton	K. Pruski	ATN&HC	Continuing	0.2	0.05
		S. Pietucha				

ORNAMENTALS, TREES AND SHELTERBELTS (continued)

PROJECT TITLE	TRIAL LOCATION	RESEARCHERS	AGENCY	STATUS AND REPORTED	PMY	TMV
Micropropagation of difficult to root geraniums	Edmonton	K. Pruski M. Mirza	ATN&HC	Complete	0.05 0.01	
Double infection of Alstroemeria with viruses	Edmonton	P. Bains	ATN&HC	Continuing	0.1	0.1

GREENHOUSE CROPS

PROJECT TITLE	TRIAL LOCATION	RESEARCHERS	AGENCY	STATUS AND REPORTED	PMY	TMY
Evaluation of a <i>Bacillus</i> sp. as an antagonist to pythium in NFT system	Edmonton	K. Chang M. Younus M. Mirza	ATN&HC	Continuing	1.0	0.3
Evaluation of tomato cultivars in NFT system	Edmonton	M. Younus	ATN&HC	Continuing	0.05	
Evaluation of peppers as an economical crop in NFT system	Edmonton	M. Younus	ATN&HC	Complete	0.05	0.2
Observations on <i>Alstroemerias</i> as a cut flower under warm temperatures	Edmonton	M. Younus K. Pruski	ATN&HC	Complete	0.05	0.1
Evaluation of humate and humalite as a growing medium amendment	Edmonton	M. Younus M. Mirza	ATN&HC	Continuing	0.01	0.02
Seed transmission of <i>Fusarium oxysporum</i> in spinach	Edmonton	K. Chang M. Mirza	ATN&HC	Complete	0.05	0.05
Interaction of root rot pathogens on <i>Alstroemeria</i>	Edmonton	K. Chang M. Mirza	ATN&HC	Complete	0.1	0.1
Effect of potassium silicate on growth of selected bedding plants in commercial greenhouses	Edmonton	M. Younus M. Mirza	ATN&HC	Complete	0.1	0.1
Nighttime feeding of calcium in seedless cucumbers	Edmonton	M. Younus M. Mirza	ATN&HC	Complete	0.1	0.2

RESEARCH PROJECTS - 1990

ALBERTA SPECIAL CROPS AND HORTICULTURAL RESEARCH CENTER

Special Crops and Agronomy Section

Cereal and Oilseed Regional Variety Trials
Field Bean Cultivar and Cultural Trials
New Crops Cultivar, Cultural Trials

Annual Forage Crop Studies
Perennial Forage Crop Studies

Irrigation Management of Special Crops
Management of Irrigation Alfalfa

Farming for the Future:

Adaptability and Agronomic Practices of Herbs, Spices and Essential Oil Crops
Salinity and Cold Tolerance of Ornamental Trees
Commercial Adaptability - Essential Oils & Spice Crops
Salinity Tolerance of Forage and Turf Grasses

Horticulture Section

Annual and Perennial Flowers
Nursery Production of Woody Ornamentals
Regional Woody Plant Hardiness Test Program
Woody Ornamentals

Cultural and Cultivar Evaluation of Greenhouse Floriculture Crops
Cultural and Cultivar Evaluation of Greenhouse Vegetable Crops
Evaluation of Chemical and Biological Agents to Control Greenhouse Pests
Evaluation of Hydroponic Systems for Growing Greenhouse Crops

Bush and Native Fruit Culture and Cultivar Improvement
Small Fruit Culture and Cultivar Improvement

Potato Cultivar Improvement
Potato Production Research

Vegetable Crop Cultivar Trials

Crop Protection and Utilization Section

Processing and Quality Evaluation of Potatoes
Processing and Quality Evaluation of Vegetables
Processing and Quality Evaluation of Fruit

Chemical Weed Control in Small and Native Fruit
Weed Control in Pulses and Special Crops
Weed Control in Vegetable Crops
Weed Control in Nursery Crops and Shelterbelts
Weed Control in Potatoes
Herbicide Carry Over

Diseases of Greenhouse Crops
Diseases of Potatoes
Diseases of Turfgrass



PUBLICATIONS





Extension Publications

- Guide to Crop Protection - Part I - Chemical
- Guide to Crop Protection - Part III - Pesticide Application Equipment
- Proceeding of the Workshop on Biological Control of Pests in Canada. A joint production with the Alberta Environmental Centre. AECV91-P1
- Alberta Weed and Pest Control Inspection Guide

Fact Sheets/Pamphlets

- 100/632 Seed Treatment of Cereal, Oilseed and Pulse Crops.
- 114/630-1 Scald and Net Blotch of Barley.
- 120/640-1 Weed Control in Forage Crops - Agri-fax.
- 643-3 Control of Leafy Spurge with Spurge Beetle - Agri-fax.
- 100/32 Varieties of Cereal and Oilseed Crops for Alberta.
- 120/32 Varieties of Perennial Hay and Pasture Crops for Alberta. Revised.
- 120/45-1 How to Purchase High Quality Forage Seed.
- 277/645-1 Chemical Weed Control for Alberta Shelterbelts

The southern Alberta Regional Crop Laboratory report 01989. ASCHRC #90-8

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- Harrison, L.M., 1990.** "Effects of fertilizer regimes on stand establishment, root rot disease and yields of Tobin canola in the Peace River region." Grow with Canola Program Summary 1985 - 1990, June.
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- Jones, J.W., 1990.** Russian Wheat Aphid Gathers Momentum in the U.S. Crop Protection Newsletter 14(5).
- Jones, J.W., 1990.** Watch for Stink Bugs this Spring. Crop Protection Newsletter. 14(6).
- Jones, J.W., 1990.** Seed Maggots Common this Spring. Crop Protection Newsletter 14(7).
- Jones, J.W., 1990.** Bertha Armyworm Moth Flights Heavy but Infestations Will be Later. Crop Protection Newsletter 14(8).
- Jones, J.W., 1990.** Bertha Armyworm Continues Upward Trend. Crop Protection Newsletter 14(10).
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- Alberta Greenhouse Notes. Eight issues.
- Alberta Produce Notes. Four issues.
- Vegetable Cultural and Cultivar Trials.

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Byers, J.R. and J.W. Jones. Incidence of Parasitism of Army Cutworm by Copidosoma spp. and Effect of Crop Damage in Southern Alberta. ECP Reports: Biological Control.

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